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Advanced System Design Service
Washington, D.C. 20591

FAA Rotorcraft Research, Engineering, and Development Bibliography, 1962-1988

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Advanced System Design Service
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Bibliography

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16. Abstract

This is a bibliography of FAA rotorcraft reports published from 1962 to 1988. This report is a supplement to an earlier bibliography, "FAA Helicopter/Heliport Research, Engineering, and Development - Bibliography, 1964-1986" (FAA/PM-86/47) (AD-A174697). Both bibliographies are limited to documents in which the research, engineering, and development elements of the FAA were involved as sponsors, participants, or authors.

This bibliography contains abstracts on 53 technical reports. The indexes in this document address these 53 reports as well as the 133 reports in the earlier bibliography (FAA/PM-86/47).

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1. INTRODUCTION. This bibliography has been assembled as an aid for those who are interested in rotorcraft/heliport research, engineering, and development. It includes those within the Federal Aviation Administration (FAA), those in industry, and those in state and local governments. This report is a supplement to "FAA Helicopter/Heliport Research, Engineering, and Development - Bibliography, 1964 - 1986" (FAA/PM-86/47) published in November 1986 (NTIS accession number AD-A174697). The bibliography and indexes in this report include all of what was published in the earlier document. However, Appendix E of this report does not contain any abstracts which were included in FAA/PM-86/47. Abstracts herein are only for those reports which have been published subsequent to the earlier bibliography plus any earlier reports which were inadvertently overlooked. This report does include all the abstracts and indexes contained in an earlier supplemental bibliography, "FAA Rotorcraft Research Engineering, and Development Bibliography, 1964 - 1987" (PS-88-1-LR).

2. SCOPE. In selecting technical reports to be included in this bibliography, two limitations have been observed. First, the reports are specifically related, in whole or in part, to rotorcraft. Second, they are limited to reports in which the research, engineering, and development elements of the FAA have been involved as sponsors, participants, or authors.

3. AVAILABILITY OF DOCUMENTS. The technical reports listed in this bibliography are readily available from three sources:

a. National Technical Information Service (NTIS). Many of the technical reports listed in this bibliography are available thru NTIS. These documents can be identified via the statement in block 18 of the technical report documentation page (Form DOT F 1700.7) contained in Appendix E of this bibliography and in Appendix E of the earlier bibliography (FAA/PM-86/47). For those reports available from NTIS, the accession number is given in block 2 of the technical report documentation page (unless it was not available at the time the bibliography was published). In ordering a document from NTIS, the accession number should be used. The cost is dependent on the number of pages in the document (see table 1). Documents are available from NTIS both in microfiche and paper copy. Generally, the paper copies are printed from microfiche.

b. American Helicopter Society (AHS). Copies of virtually all of the technical reports listed in this bibliography have been given to AHS. Both AHS members and nonmembers may obtain copies of reports for a small fee.

c. Helicopter Association International (HAI). Copies of virtually all of the technical reports listed in this

bibliography have been given to HAI. HAI members may obtain copies of reports for a small fee.

4. ORDER OF THE LISTING. In the bibliographic listing (see Appendix A), technical reports are listed in order of the year in which they were published. Within the year of publication, reports are listed sequentially according to report number. Some reports do not include the year of publication as part of the document number. Such a report is listed after other reports published in the same year. (e.g., NAE-AN-26, published in 1985, is listed after the other reports published in 1985.)

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5. NEW DOCUMENTS OF PARTICULAR INTEREST. Based on discussions with people in industry, the following new technical reports cover topics of wide spread interest.

a. FAA/PM-87/31 Analyses of Heliport System Plans

b. FAA/PM-87/32 Four Urban Heliport Case Studies

c. FAA/PM-87/33 Heliport System Planning Guidelines

Commentary: Documents a, b, and c are part of an FAA effort to promote heliports. The FAA plans to use these three technical reports to develop heliport planning sections that will be added to two FAA advisory circulars: AC 150/5050-3A, Planning the State Airport System, and AC 150/5070-5, Planning the Metropolitan Airport System. The revised advisory circulars will help ensure standardization in the forecasting, data collection, and data presentation methods and procedures used in heliport planning.

d. FAA/CT-TN87/40 Heliport Visual Approach and Departure Airspace Tests, Volume I: Summary

e. FAA/DS-88/12 Minimum Required Heliport Airspace Under Visual Flight Rules

Commentary: Documents d and e are the first of a number of technical reports addressing the validation/revision of the minimum required heliport airspace under visual flight rules (VFR).

f. FAA/DS-88/5 Aeronautical Decision Making for Air Ambulance Helicopter Pilots: Learning from Past Mistakes

g. FAA/DS-88/6 Aeronautical Decision Making for Air Ambulance Helicopter Pilots: Situational Awareness Exercises

Commentary: Documents f and g are the first of a family of technical reports addressing judgment training for air ambulance helicopter pilots. These two documents supplement the material contained in FAA/PM-86/45, Aeronautical Decision Making for Helicopter Pilots.

h. FAA/DS-88/2 "Zero/Zero" Rotorcraft Certification Issues

Commentary: Document h is a three volume report documenting the results of a certification issues forum held in Phoenix, Arizona in August 1987. This report documents; from the viewpoints of manufacturers, operators, researchers, and the FAA; certification issues that must be addressed in order to allow rotorcraft to fly in extremely low visibility conditions.

APPENDIX A: BIBLIOGRAPHY

115-608-3X (June 1962)	A Simulation Study of IFR Helicopter Operations in the New York Area (A.L. Sluka, J.R. Bradley, D.W. Yungman, D.A. Martin and Franklin Institute Laboratories)
RD-64-4	State-of-the-Art Survey for Minimum Approach, Landing and Takeoff Intervals as Dictated by Wakes, Vortices, and Weather Phenomena (W.J. Bennett)
RD-64-55	Analytical Determination of the Velocity Fields in the Wakes of Specified Aircraft (W.J. Bennett)
RD-66-46	VORTAC Error Analysis for Helicopter Navigation, New York City Area (Ronald Braff)
RD-66-68	V/STOL Approach System Steep Angle Flight Tests (Glen D. Adams)
NA-67-1 DS-67-23	An Analysis of the Helicopter Height Velocity Diagram Including a Practical Method for its Determination (William J. Hanley, Gilbert Devore)
RD-67-36	Economic and Technical Feasibility Analysis of Establishing an All-Weather V/STOL Transportation System (Joseph M. Del Balzo)
RD-67-68 NA-68-21	VTOL and STOL Simulation Study (Robert C. Conway)
NA-69-2 RD-68-61	Flight Test and Evaluation of Heliport Lighting for VFR (Richard L. Sulzer, Thomas H. Paprocki)
FAA-RD-70-10 FAA-NA-70-7	Evaluation of LORAN-C/D Airborne Systems (George H. Quinn)
FAA-RD-71-96 FAA-NA-71-45	Analytical Study of the Adequacy of VOR/DME and DME/DME Guidance Signals for V/STOL Area Navigation in the Los Angeles Area (Bernhart V. Dinerman)
FAA-RD-71-105	Heliport Beacon Design, Construction, and Testing (Fred Walter)
FAA-NA-72-39	Index of NAFEC Technical Reports, 1967-1971
FAA-NA-72-41	Collision Avoidance: An Annotated Bibliography, September 1968 --- April 1972 (Dorothy E. Bulford)

FAA-RD-72-133 FAA-NA-72-89	Flight Test and Evaluation of Heliport Lighting for IFR (Thomas H. Paprocki)
FAA-EM-73-8	Civil Aviation Midair Collisions Analysis, January 1964 - December 1971 (T.R. Simpson, R.A. Rucker, J.P. Murray)
FAA-EM-73-8 Addendum 1	Civil Aviation Midair Collisions Analysis, 1972 Added to 1964-1971 Results (R.A. Rucker, T.R. Simpson)
FAA-RD-73-47 FAA-NA-72-95	ATC Concepts for V/STOL Vehicles, Parts 1 and 2 (Sidney B. Rossiter, John Maurer, Paul J. O'Brien)
FAA-RD-73-145	V/STOL Noise Prediction and Reduction (Wiley A. Guinn, Dennis F. Blakney, John S. Gibson)
FAA-RD-74-48 FAA-NA-73-68	A Summary of Helicopter Vorticity and Wake Turbulence Publications with an Annotated Bibliography (Jack J. Shrager)
FAA-RD-75-79	A Comprehensive Review of Helicopter Noise Literature (B. Magliozzi, F.B. Metzger, W. Bausch, R.J. King)
FAA-RD-75-94	Wind and Turbulence Information for Vertical and Short Take-Off and Landing (V/STOL) Operations in Built-Up Urban Areas-Results of Meteorological Survey (J.V. Ramsdell)
FAA-RD-75-125	V/STOL Aircraft Noise Predictions (Jet Propulsors) (N.N. Reddy, D.F. Blakney, J.G. Tibbets, J.S. Gibson)
FAA-RD-75-190	Noise Certification Criteria and Implementation Considerations for V/STOL Aircraft (MAN-Acoustics and Noise, Inc.)
FAA-RD-76-1	Human Response to Sound: The Calculation of Preceived Level, PLdB (Noisiness or Loudness) Directly From Physical Measures (Thomas H. Higgins)
FAA-RD-76-49	V/STOL Rotary Propulsion Systems - Noise Prediction and Reduction (B. Magliozzi) Vol-I: Identification of Sources, Noise Generating Mechanisms, Noise Reduction Mechanisms, and Prediction Methodology Vol-II: Graphical Prediction Methods Vol-III: Computer Program User's Manual

FAA-RD-76-100 NASA TM X-73,124	Progress Toward Development of Civil Airworthiness Criteria for Powered-Lift Aircraft (Barry C. Scott, Charles S. Hynes, Paul W. Martin, Ralph B. Bryder)
FAA-RD-76-116	Noise Certification Considerations for Helicopters Based on Laboratory Measurements (MAN-Acoustics and Noise)
FAA-RD-76-146	A Comparison of Air Radio Navigation Systems (For Helicopters In Off-Shore Areas) (George H. Quinn)
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FAA-RD-77-100	Study to Improve Turbine Engine Rotor Blade Containment (K.F. Heermann, R.H. Eriksson, K.R. McClure)
NA-78-55-LR	Limited Test of LORAN-C and Omega for Helicopter Operations in the Offshore New Jersey Area (Robert H. Pursel)
FAA-RD-78-101	Helicopter Operations Development Plan
FAA-RD-78-143	Aircraft Wake Vortex Takeoff Tests at Toronto International Airport (Thomas Sullivan, James Hallock, Berl Winston, Ian McWilliams, David C. Burnham)
FAA-RD-78-150	Helicopter Air Traffic Control Operations
FAA-RD-78-157	Review of Airworthiness Standards for Certification of Helicopters for Instrument Flight Rules (IFR) Operations (Joseph J. Traybar, David L. Green, Albert G. Delucien)

FAA-RD-79-59	Powered-Lift Aircraft Handling Qualities in the Presence of Natually-Occurring and Computer-Generated Atmospheric Disturbances (Wayne F. Jewell, Warren F. Clement, Thomas C. West, Dr. S.R.M. Sinclair)
FAA-RD-79-64	Workload and the Certification of Helicopters for IFR Operations (Albert G. Delucien, David L. Green, Steven W. Jordan, Joseph J. Traybar)
FAA-RD-79-99	Airborne Radar Approach System Flight Test Experiment (Larry D. King, Richard J. Adams)
FAA-RD-79-123 FAA-NA-79-22	Test and Evaluation of Air/Ground Communications for Helicopter Operations in the Offshore New Jersey, Baltimore Canyon Oil Exploration Area (James J. Coyle)
FAA-RD-80-17 FAA-NA-80-13	Northeast Corridor User Evaluation (Joseph Harrigan)
FAA-RD-80-18 FAA-NA-80-8	Flight Evaluation of a Radar Cursor Technique as an Aid to Airborne Radar Approaches (Joseph Perez)
FAA-RD-80-20	Helicopter Communications System Study (Michael White, Dana Swann)
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FAA-RD-80-24	Icing Characteristics of Low Altitude, Super Cooled Layer Clouds (Richard K. Jeck)
NA-80-34-LR	Survey of Heliport Lighting and Marking Systems (Thomas H. Paprocki)
FAA-RD-80-47 FAA-CT-80-18	Flight Test Investigation of LORAN-C for En Route Navigation in the Gulf of Mexico (Robert H. Pursel)
FAA-RD-80-58	Study of Helicopter Performance and Terminal Instrument Procedures (Albert G. DeLucien, David L. Green, H.R. Price, F.D. Smith)
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FAA/RD-82/24 FAA/CT-82/32	LORAN-C En Route Accuracies in the Central Appalachian Region (Frank Lorge)

FAA/RD-82/40	Application of the MLS to Helicopter Operations (Edwin D. McConkey, John B. McKinley, Ronald E. Ace)
FAA/CT-82/57	Northeast Corridor Helicopter Area Navigation Accuracy Evaluation (Jack D. Edmonds)
FAA/RD-82/63	EMC Analysis of a Prototype Civil-Use GPS Receiver on Four Aircraft Configurations (Robert L. Mullen)
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FAA/CT-82/120	All Weather Heliport (Paul H. Jones)
FAA/CT-82/143	Safety Benefits Analysis of General Aviation Cockpit Standardization (Bruce E. Beddow, Sidney Berger, Charles E. Roberts, Jr.)
FAA/CT-82/152	Review of Aircraft Crash Structural Response Research (Emmett A. Witmer, David J. Steigmann)
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FAA/CT-TN83/50 and Addendum 1	Altitude Aided GPS (George Paolacci)
FAA/CT-TN84/16	Helicopter MLS (Collocated) Flight Test Plan to Determine Optimum Course Width (James H. Enias)
FAA/CT-TN84/20	Helicopter MLS Collocated Flight Test for TERPS Data (James H. Enias, Paul Maenza, Donald P. Pate)
FAA/PM-84/22	Heliport Snow and Ice Control, Methods and Guidelines (John B. McKinley, Robert B. Newman)
FAA/PM-84/23	Structural Design Guidelines for Heliports (Charles W. Schwartz, Matthew W. Witczak, Rita B. Leahy)
FAA/PM-84/25	Evaluating Wind Flow Around Buildings on Heliport Placement (John B. McKinley)
FAA/PM-84/31	Very Short Range Statistical Forecasting of Automated Weather Observations (Robert G. Miller)
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FAA/CT-TN84/47	Global Positioning System Performance During FAA Helicopter Tests on Rotor Effects (Jerome T. Connor, George Paolacci)
PM-85-2-LR	Heliport Design Guide, Workshop Report Volume 1: Executive Summary
PM-85-3-LR	Volume 2: Appendixes
PM-85-4-LR	Volume 3: Viewgraphs
FAA/CT-TN85/5	Gulf of Mexico Helicopter Loran C Stability Study (Roseann M. Weiss)
FAA/PM-85/6	Helicopter User Survey: TCAS (Frank R. Taylor)
FAA/CT-85/7	State-of-The-Art Review on Composite Material Fatigue/Damage Tolerance (Regional L. Amory, David S. Wang)

FAA/PM-85/7	MLS for Heliport Operators, Owners, and Users (Kristen J. Venezia, Edwin D. McConkey)
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FAA/CT-TN85/23	Test Plan for Siting, Installation, and Operational Suitability of the AWOS at Heliports (Rene' A. Matos)
FAA/CT-TN85/24	Helicopter Terminal Instrument Approach Procedures (VOR/ILS) (Christopher Wolf)
FAA/CT-85/26	Summary of Artificial and Natural Icing Tests Conducted on U.S. Army Aircraft from 1974 to 1985 (Harry W. Chambers, John Y. Adams)
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FAA/CT-TN85/43	Helicopter MLS RNAV Development and Flight Test Project, Project Plan (James H. Remer)
FAA/CT-TN85/49	Test Plan for Rotorcraft Traffic Alert and Collision Avoidance System (TCAS) (Albert J. Rehmann)
FAA/CT-TN85/53	Validation of MLS Siting Criteria for MLS Steep Angle Approaches to a Heliport (Scott Shollenberger)
FAA/CT-TN85/55	Pilot Inflight Evaluation of MLS Procedures at Heliports (James H. Enias)

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FAA/CT-TN85/60	Rotorcraft TCAS Evaluation, Group 1 Results (Albert J. Rehmann)
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FAA/CT-TN86/42	Heliport MLS Decelerating Test Plan (Scott B. Shollenberger, Barry R. Billmann)
FAA/PM-86/45	Aeronautical Decision Making for Helicopter Pilots (Richard J. Adams, Jack L. Thompson)
FAA/PM-86/47	FAA Helicopter/Heliport Research, Engineering, and Development Bibliography, 1964-1986 (Robert D. Smith)
FAA/PM-86/52 FAA/CT-87/3	The Operational Suitability of the Automated Weather Observing System (AWOS) at Heliports (Rene' A. Matos, Rosanne M. Weiss)

FAA/CT-TN86/56	LORAN-C VNAV Approaches to the FAA Technical Center Heliport (Michael Magrogan)
FAA/CT-TN86/61	Heliport Visual Approach Surface Testing Test Plan (Rosanne M. Weiss, John R. Sackett)
FAA/CT-TN86/63	Helicopter Manuevering: MLS Shuttle Holding Pattern Data Report (Christopher J. Wolf, Raquel Y. Santana)
FAA/CT-TN86/64	Heliport Critical Area Flight Test Results (Barry R. Billmann, Michael M. Webb, John Morrow, Donald W. Gallager, Christopher J. Wolf)
FAA/AVN-200/25	Helicopter Microwave Landing System (MLS) Flight Test (Charles Hale, Paul Maenza) June 1986
FAA/PM-87/2	Very Short Range Statistical Forecasting of Automated Weather Observations (Robert G. Miller)
FAA/CT-TN87/4	Simulation Tests of Proposed Instrument Approach Lighting Systems for Helicopter Operations (Paul H. Jones)
FAA/CT-TN87/10	Heliport Parking, Taxiing, and Landing Area Criteria Test Plan (Rosanne M. Weiss)
FAA/CT-TN87/16	Test Plan for Helicopter GPS Applications (Michael Magrogan)
FAA/CT-87/19	Avionics System Design for High Energy Fields (Roger A. McConnell)
FAA/CT-TN87/19	Microwave Landing System Area Navigation (MLS RNAV) Transformation Algorithms and Accuracy Testing (Barry Billmann, James H. Remer, Min-Ju Chang)
FAA/CT-TN87/21	Rotorcraft TCAS Evaluation, Group 3 Results (Albert J. Rehmann)
FAA/PM-87/31 FAA/PP-88/1	Analyses of Heliport System Plans (Deborah Peisen, Jack T. Thompson)
FAA/PM-87/32 FAA/PP-88/2	Four Urban Heliport Case Studies (Deborah Peisen, Jack T. Thompson)
FAA/PM-87/33 FAA/PP-88/3	Heliport System Planning Guidelines (Deborah Peisen)

FAA/CT-TN87/40	Heliport Visual Approach and Departure Airspace Tests (Rosanne M. Weiss, Christopher J. Wolf, Maureen Harris, James Triantos)
	Vol-I: Summary
PS-88-1-LR	FAA Rotorcraft Research, Engineering, and Development Bibliography, 1964-1987 (Robert D. Smith)
FAA/DS-88/2 FAA/PS-88/8 NASA CR 177483	"Zero/Zero" Rotorcraft Certification Issues (Richard J. Adams)
	Vol-I: Executive Summary Vol-II: Plenary Session Presentations Vol-III: Working Group Results
FAA/PS-88/3	Very Short Range Statistical Forecasting of Automated Weather Observations (Robert G. Miller)
FAA/CT-TN88/5	Heliport Visual Approach Surface High Temperature and High Altitude Test Plan (Marvin S. Plotka, Rosanne M. Weiss)
FAA/DS-88/5	Aeronautical Decision Making for Air Ambulance Helicopter Pilots: Learning from Past Mistakes (Richard J. Adams and Jack T. Thompson)
FAA/DS-88/6	Aeronautical Decision Making for Air Ambulance Helicopter Pilots: Situational Awareness Exercises (Richard J. Adams, Jack T. Thompson)
FAA/CT-TN88/8	LORAN-C Offshore Flight Following (LOFF) In the Gulf of Mexico (Frank Lorge)
FAA/DS-88/12	Minimum Required Heliport Airspace Under Visual Flight Rules (Robert D. Smith)
FAA/CT-88/21	Experimental Guidelines for the Design of Turbine Rotor Fragment Containment Rings (James T. Salvino, Robert A. DeLucia, Tracy Russo)
FAA/CT-88/23	Statistics on Aircraft Gas Turbine Engine Rotor Failures that Occurred in U.S. Commercial Aviation During 1982 (Robert A. Delucia, James T. Salvino)

APPENDIX B: SUBJECT INDEX

AWOS (See Automated Weather Observing System)

AWOS GEM (Short-range Weather Forecasting)

FAA/PM-84/31 FAA/PM-86/10 FAA/PM-87/2
FAA/PS-88/3

BIBLIOGRAPHY

FAA-NA-72-39 FAA-RD-74-48 FAA-RD-75-79
FAA-EM-77-15 FAA-RD-81-7-LR FAA-CT-81-54
FAA/CT-82/152 FAA/PM-86/47 PS-88-1-LR

CHARTING

FAA-RD-78-150

COLLISION AVOIDANCE SYSTEM (See also TCAS)

FAA-NA-72-41 FAA-EM-73-8 FAA-EM-73-8 (Add. 1)
FAA-RD-80-88,I FAA-RD-81-59

COMPOSITE MATERIALS (See also Lightning and Electromagnetic Interference)

FAA/CT-82/152 FAA/CT-85/7 FAA/CT-86/8
FAA/CT-87/19

COST/BENEFIT ANALYSIS

RD-67-36 FAA/RD-82/6 FAA/RD-82/40
FAA/PM-84/22

CRASHWORTHINESS (See also Fire Safety)

FAA-RD-78-101 FAA/CT-82/152 FAA/CT-85/11
FAA/CT-86/35

DECELERATING APPROACHES (See Low-speed Approaches and MLS)

DEPENDENT SURVEILLANCE (See also LOFF)

FAA-RD-80-85

DISTANCE MEASURING EQUIPMENT (DME)

RD-66-46 FAA-RD-71-96 FAA-RD-76-146
FAA-RD-80-17 NA-80-34-LR FAA/RD-82/6
FAA/RD-82/63 FAA/RD-82/78 FAA/PM-86/14
FAA/PM-86/15 FAA/PM-86/25,I FAA/CT-TN86/30
FAA/CT-TN86/42 FAA/CT-TN87/19

DOPPLER NAVIGATION

FAA-RD-76-146

DOWNWASH (See also Wake Vortexes)

FAA/CT-TN87/10

ELECTROMAGNETIC INTERFERENCE (EMI) (See Lightning and Electromagnetic Interference)

EMERGENCY MEDICAL SERVICE (EMS)

FAA/DS-88/5 FAA/DS-88/6

FIRE SAFETY (See also Crashworthiness)

FAA/CT-86/24

FLIGHT CONTROLS

FAA-RD-78-157 FAA-RD-79-64 FAA-RD-80-64
FAA/CT-82/143 FAA/PM-86/14 FAA/PM-86/15
NAE-AN-26 (1985)

FLIGHT DIRECTORS

FAA-RD-78-157 FAA-RD-81-7-LR FAA/PM-86/25,I

FLIGHT DISPLAYS

FAA-RD-78-157 FAA/CT-82/143 FAA/PM-85/30

FLIGHT INSPECTION

FAA/PM-85/7 FAA/CT-TN86/14

FLY BY WIRE (See Lighting and Electromagnetic Interference)

GENERALIZED EQUIVALENT MARKOV (GEM) (See Weather Forecasts and AWOS GEM)

GLOBAL POSITIONING SYSTEM (GPS)

FAA-RD-76-146 FAA-RD-78-101 FAA-RD-78-150
FAA-RD-80-85 FAA/RD-82/6 FAA/RD-82/8
FAA/RD-82/9 FAA/RD-82/63 FAA/RD-82/71
FAA/RD-82/103 FAA/CT-TN83/03 FAA/CT-TN83/50
FAA/CT-TN84/47 FAA/PM-86/14 FAA/PM-86/15
FAA/CT-TN87/16

GULF OF MEXICO (See also LOFF and Offshore Operations)

NA-80-34-LR	FAA-RD-80-47	FAA-RD-80-85
FAA-RD-80-87	FAA-RD-80-88	FAA/RD-81/40
FAA-RD-81-59	FAA/RD-82/7	FAA/CT-TN85/5

HANDLING QUALITIES

FAA-RD-78-157	FAA-RD-79-59	FAA-RD-79-64
FAA-RD-80-58	FAA-RD-80-64	FAA/CT-83/6
NAE-AN-26 (1985)		

HEIGHT-VELOCITY DIAGRAM

NA-67-1	FAA-RD-80-58	FAA-RD-80-88,II
FAA/PM-86/28		

HELICOPTER NOISE (See Noise)

HELICOPTER OPERATIONS STATISTICS

FAA/CT-83/40	FAA/PM-85/6	FAA/CT-85/11
FAA/PM-86/28		

HELICOPTER PERFORMANCE

FAA-RD-80-58	FAA-RD-80-107	FAA/RD-81/35

HELIPORT AIRSPACE (See also Heliport VFR Airspace and TERPS)

FAA-RD-80-58	FAA-RD-80-107	FAA/RD-81/35
FAA/CT-TN87/40	FAA/CT-TN88/5	FAA/DS-88/12

HELIPORT CASE STUDIES

FAA/PM-87/32

HELIPORT DESIGN (See also Heliport Airspace, Heliport Lighting, Heliport Parking Areas, Heliport VFR Airspace, MLS Siting, and AWOS)

FAA-RD-78-101	FAA-RD-80-107	FAA-RD-81-35
FAA/CT-82/120	FAA/PM-84/22	FAA/PM-84/23
FAA/PM-84/25	FAA/CT-TN84/31	PM-85-2-LR
PM-85-3-LR	PM-85-4-LR	FAA/PM-85/7
FAA/CT-TN86/61	FAA/CT-TN86/64	FAA/DS-88/12

HELIPORT LIGHTING/MARKING

NA-69-2	FAA-RD-71-105	FAA-RD-72-133
FAA-RD-78-101	NA-80-34-LR	FAA-RD-80-59
FAA/CT-82/120	FAA/CT-TN84/34	FAA/CT-TN86/22
FAA/CT-TN87/4		

HELIPORT PARKING AREAS AND TAXIWAYS

FAA/CT-TN87/10

HELIPORT PLANNING

FAA-RD-80-107 FAA/RD-81/35 FAA/PM-84/22
FAA/PM-84/25 FAA/PM-87/31 FAA/PM-87/32
FAA/PM-87/33

HELIPORT SNOW AND ICE CONTROL

FAA/PM-84/22

HELIPORT VFR AIRSPACE

FAA-RD-80-107 FAA/RD-81/35 FAA/CT-TN86/61
FAA/CT-TN87/40 FAA/CT-TN88/5 FAA/DS-88/12

HIGH FREQUENCY (HF) COMMUNICATION

FAA-RD-78-150

HOLDING PATTERNS

FAA-RD-78-150 FAA-RD-80-59 FAA-RD-80-80
FAA-RD-80-86 FAA-RD-80-88 FAA/CT-TN86/63

HUMAN FACTORS (See also Flight Controls, Flight Displays, TCAS and Training)

FAA-RD-81-59 FAA/CT-83/6 FAA/CT-83/40
FAA/PM-86/28 FAA/PM-86/45

ICING (See also Weather and Weather Forecasting)

FAA-RD-78-101 FAA-RD-80-24 FAA-CT-80-210
FAA/CT-81/35 FAA/CT-83/7 FAA/CT-83/21
FAA/CT-83/22 FAA/PM-84/22 FAA/CT-85/26
FAA/CT-86/35

INERTIAL NAVIGATION SYSTEM (INS)

FAA-RD-76-146 FAA-RD-80-85 FAA/RD-82/7
FAA/RD-82/24

INSTRUMENT LANDING SYSTEM (ILS)

FAA/RD-82/6 FAA/CT-TN85/24 FAA/PM-86/14
FAA/PM-86/15 FAA/PM-86/25,I

LIGHTING (See Heliport Lighting)

LIGHTNING AND ELECTROMAGNETIC INTERFERENCE (EMI)

FAA/CT-86/8	FAA/CT-87/19

LORAN-C (See also LOFF)

FAA-RD-70-10	FAA-RD-76-146	NA-78-55-LR
FAA-RD-78-101	FAA-RD-78-150	FAA-RD-80-20
FAA-RD-80-47	FAA-RD-80-85	FAA-RD-80-87
FAA-RD-80-88	FAA-CT-80-175	FAA-RD-81-27
FAA-RD-81-59	FAA/RD-82/6	FAA/RD-82/7
FAA/RD-82/16	FAA/RD-82/24	FAA/RD-82/57
FAA/RD-82/78	FAA/PM-83/4	FAA/PM-83/32
FAA/CT-TN85/5	FAA/CT-TN85/17	FAA/PM-86/14
FAA/PM-86/15		

LORAN-C VERTICAL NAVIGATION (VNAV)

FAA/RD-82/16	FAA/CT-TN86/56

LORAN FLIGHT FOLLOWING (LOFF)

FAA-RD-80-85	FAA-RD-80-87	FAA-RD-80-88
FAA-RD-81-55	FAA-RD-81-59	FAA/CT-TN86/17
FAA/CT-TN88/8		

LOW-ALTITUDE COMMUNICATIONS (See also Northeast Corridor)

FAA-RD-78-101	FAA-RD-78-150	FAA-RD-79-123
FAA-RD-80-20	FAA-RD-80-80	FAA-RD-80-87
FAA-RD-81-9	FAA/RD-81/40	FAA-RD-81-59
PM-85-2-LR	FAA/PM-85/8	

LOW-ALTITUDE NAVIGATION (See also LORAN-C, Northeast Corridor, and GPS)

RD-66-46	RD-67-36	FAA-RD-71-96
FAA-RD-76-146	NA-78-55-LR	FAA-RD-78-101
FAA-RD-78-150	FAA-CT-80-18	FAA-RD-80-20
FAA-RD-80-80	FAA-RD-80-87	FAA-RD-81-59
FAA/PM-83/32		

LOW-ALTITUDE SURVEILLANCE (See also LOFF)

FAA-RD-78-150	FAA-RD-80-20	FAA-RD-80-80
FAA-RD-80-87	FAA-RD-81-59	

LOW-SPEED APPROACHES

NA-68-21	FAA-RD-80-58	NAE-AN-26 (1985)
FAA/PM-86/14	FAA/PM-86/15	FAA/CT-TN86/31
NAE-AN-26 (1985)	FAA/CT-TN86/42	

MARKING/LIGHTING OF HELIPORTS (See Heliport Lighting/Marking)

MICROWAVE LANDING SYSTEM (MLS) FLIGHT INSPECTION (See Flight Inspection)

MLS, GENERAL (See also DME and other MLS listings below)

RD-66-68	FAA-RD-78-101	FAA/RD-82/6
FAA/RD-82/40	FAA/CT-TN84/16	FAA/CT-TN84/20
FAA/CT-TN84/40	FAA/PM-85/7	FAA/CT-TN85/15
FAA/CT-TN85/53	FAA/CT-TN85/55	FAA/CT-TN85/58
FAA/CT-TN85/63	FAA/CT-TN85/64	FAA/CT-86/14
FAA/PM-86/14	FAA/PM-86/15	FAA/CT-TN86/30
FAA/CT-TN86/40	FAA/CT-TN86/42	FAA/AVN-200/25 (1986)

MLS RNAV (See also other MLS listings)

FAA-RD-80-59	FAA/RD-82/40	FAA/PM-85/7
FAA/CT-TN85/43	FAA/CT-TN85/63	FAA/PM-86/25, I
FAA/CT-TN87/19		

MLS SITING (See also other MLS listings)

FAA/CT-TN84/40	FAA/CT-TN85/53	FAA/CT-85/58
FAA/CT-TN85/64	FAA/CT-TN86/64	

MLS TERPS (See also TERPS and other MLS listings)

FAA-RD-80-59	FAA-RD-81-167	FAA/CT-TN84/16
FAA/CT-TN84/20	FAA/CT-TN85/53	FAA/CT-TN85/55
FAA/CT-TN86/31	FAA/CT-TN86/63	
FAA/AVN-200-25 (1986)		

MID-AIR COLLISIONS (See Near Mid-air Collisions)

MILITARY TRAINING ROUTES

FAA-RD-80-88,I

NAVIGATION SATELLITE TIMING AND RANGING (NAVSTAR) (See GPS)

NEAR MID-AIR COLLISIONS (See also TCAS)

FAA-NA-72-41	FAA-EM-73-8	FAA-EM-73-8 (Add. 1)
FAA-RD-80-88,I	FAA/CT-83/40	FAA/PM-85/6

NOISE

FAA-RD-73-145	FAA-RD-75-79	FAA-RD-75-125
FAA-RD-75-190	FAA-RD-76-1	FAA-RD-76-49
FAA-RD-76-116	FAA-RD-77-57	FAA-RD-77-94
FAA-RD-78-101		

Note: During the late 1970's, responsibility for issues regarding helicopter noise was transferred to the FAA Office of Environment and Energy (AEE). The reports listed in this bibliography are limited to those in which the research, engineering, and development elements of the FAA (i.e., the ADM complex and its organizational ancestors) have been involved as sponsors, participants, or authors. Since AEE is outside the ADM complex, the reports they have published on helicopter noise are not listed herein.

NONDIRECTIONAL BEACON (NDB)

FAA-RD-76-146	FAA-RD-78-101	FAA-RD-78-150
FAA-RD-80-85	FAA/RD-82/6	FAA/PM-86/25,I

NONPRECISION APPROACHES (See also Airborne Radar Approaches)

NA-80-34-LR	FAA-CT-80-175	FAA-RD-81-27
FAA/RD-82/8	FAA/RD-82/9	FAA/RD-82/16
FAA/RD-82/71	FAA/RD-82/78	FAA/CT-82/103
FAA/CT-TN83/03	FAA/CT-TN84/34	FAA/CT-TN85/17
FAA/PM-86/25,I	FAA/CT-TN86/56	

NORTHEAST CORRIDOR

RD-66-46	RD-67-36	FAA-RD-70-10
FAA-RD-80-17	FAA-RD-80-59	FAA-RD-80-80
FAA-CT-80-175	FAA-RD-81-59	FAA/CT-82/57
FAA/RD-82/78	FAA/CT-TN85/17	

OBSTRUCTION AVOIDANCE (See also Airborne Radar Approaches, Heliport VFR Airspace, and TERPS)

FAA-RD-81-59	FAA-RD-80-107	FAA/PM-86/28

OFFSHORE OPERATIONS (See also Gulf of Mexico and Airborne Radar Approaches)

FAA-RD-76-146	NA-78-55-LR	FAA-RD-79-123
FAA-RD-80-20	NA-80-34-LR	FAA-RD-80-87
FAA-RD-80-107	FAA-RD-81-27	FAA-RD-81-55
FAA/RD-82/6	FAA/PM-83/4	

OMEGA

NA-78-55-LR	FAA-RD-78-101	FAA-RD-78-150
FAA-RD-80-85	FAA-RD-80-88,II	FAA/RD-82/6
FAA/PM-86/14	FAA/PM-86/15	

PARKING AREAS (See Heliport Parking Areas and Taxiways)

PILOT WORKLOAD (See Workload)

POWERED-LIFT AIRCRAFT (See also Tiltrotor)

FAA-RD-76-100	FAA-RD-78-100	FAA-RD-79-59

PRECISION APPROACH RADAR (PAR)

FAA-RD-80-107

RNAV (See Area Navigation and MLS RNAV)

ROTOR BLADE CONTAINMENT

FAA-RD-77-100	FAA/CT-86/42	FAA/CT-88/21
FAA/CT-88/23		

SAFETY (While this topic is addressed in most of the documents in this bibliography, the following documents are of particular interest.)

FAA/CT-82/143	FAA/CT-82/152	FAA/CT-83/6
PM-85-2-LR	PM-85-3-LR	PM-85-4-LR
FAA/PM-85/6	FAA/CT-86/24	FAA/PM-86/28
FAA/CT-86/42	FAA/PM-86/45	FAA/DS-88/5
FAA/DS-88/6	FAA/DS-88/12	

SATELLITES (See Global Positioning System)

SIMULATION

115-608-3X	NA-68-21	FAA-RD-79-59
FAA-RD-80-64	FAA-RD-80-86	FAA-RD-80-86
FAA-RD-80-88	FAA-RD-81-59	FAA/CT-85/11
FAA/PM-86/14	FAA/PM-86/15	

SNOW AND ICE (See Heliport Snow and Ice Control)

SURVEILLANCE (See also LOFF)

FAA-EM-73-8	FAA-EM-73-8 (Add. 1)

TACAN

RD-66-46	FAA-RD-76-146	FAA-RD-78-101
FAA-RD-80-88,II	FAA/RD-82/6	FAA/RD-82/63

TAXIWAYS (See Heliport Parking and Taxiways)

TERMINAL INSTRUMENT PROCEDURES (TERPS)

FAA-RD-78-150	FAA-RD-80-17	FAA-RD-80-58
FAA-RD-80-59	FAA-RD-80-80	FAA-RD-80-107
FAA-CT-81-167	FAA/CT-TN84/16	FAA/CT-TN84/20
FAA/CT-TN85/15	FAA/CT-TN85/24	FAA/CT-TN85/53
FAA/CT-TN85/55	FAA/PM-86/14	FAA/PM-86/15
FAA/AVN-200-25 (1986)		

TILTROTOR (See also Powered-Lift Aircraft)

FAA-RD-78-150

TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS)

FAA/RD-82/63	FAA/CT-83/40	FAA/PM-85/6
FAA/PM-85/29	FAA/PM-85/30	FAA/CT-TN85/49
FAA/CT-TN85/60	FAA/CT-TN85/83	FAA/CT-TN86/24
FAA/CT-TN87/21		

TRAINING (See also Aeronautical Decision Making)

FAA-RD-78-150	FAA-RD-80-88	FAA-RD-81-59
FAA/CT-83/6	FAA/CT-TN85/55	FAA/PM-86/28
FAA/PM-86/45	FAA/AVN-200/25 (1986)	

VERTIPORTS (See Heliports)

VFR HELIPORT AIRSPACE (See Heliport VFR Airspace)

VERY LIGHT WEIGHT AIR TRAFFIC MANAGEMENT EQUIPMENT (VLATME)

FAA-RD-80-87

VNAV (See LORAN-C Vertical Navigation)

VOR

RD-66-46	FAA-RD-71-96	FAA-RD-76-146
FAA-RD-78-101	FAA-RD-78-150	FAA-RD-80-17
NA-80-34-LR	FAA-RD-80-64	FAA-RD-80-85
FAA/RD-82/6	FAA/RD-82/78	FAA/CT-TN85/24
FAA/PM-86/14	FAA/PM-86/15	FAA/PM-86/25,I

WAKE VORTEXES (See also Down Wash)

RD-64-4	RD-64-55	FAA-RD-74-48
FAA-RD-78-143	FAA-RD-80-87	FAA-RD-80-88,II

APPENDIX C: AUTHOR INDEX

BERGER, SIDNEY (Kappa Systems Inc.)

FAA/CT-82/143

BILLMANN, BARRY R. (FAA Technical Center)

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FAA/CT-TN86/64 FAA/CT-TN87/19

BLAKNEY, DENNIS F. (Lockheed-Georgia)

FAA-RD-73-145 FAA-RD-75-125

BOLUKBASI, AKIF O. (Simula Inc.)

FAA/CT-85/11

BOLZ, ERIC H. (Systems Control Technology)

FAA/RD-82/16 FAA/PM-85/8

BOYLAN, NANCY G. (FAA,NAFEC)

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BRADLEY, J.R. (FAA, NAFEC)

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BRYDER, RALPH B. (Civil Aviation Authority)

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BULFORD, DOROTHY E. (FAA, NAFEC)

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BURNHAM, DAVID C. (Transportation System Center)

FAA-RD-78-143

CHAMBERS, HARRY W. (FAA Technical Center)

FAA/CT-85/26

CHANG, MIN-JU (FAA Technical Center)

FAA/CT-TN87/19

CLARKE, RICHARD (Events Analysis, Inc.)

FAA/CT-86/24

CLEMENT, WARREN F. (Systems Technology)

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COLTMAN, JOSEPH W. (Simula Inc.)

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CONNOR, JEROME T. (FAA Technical Center)

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CONWAY, ROBERT C. (FAA, NAFEC)

NA-68-21

COOLEY, WILLIAM W. (Science & Engineering Associates, Inc.)

FAA/CT-86/8

COYLE, JAMES J. (FAA, NAFEC)

FAA-RD-79-123

CROSWELL, THOMAS H. (RJO Enterprises)

FAA/PM-86/25

CUSHMAN, ARTHUR W. (FAA Technical Center)

FAA/CT-TN85/83

DADONE, L.U. (Boeing Vertol)

FAA-CT-80-210

DEL BALZO, JOSEPH M. (FAA, Washington)

RD-67-36

DeLUCIA, ROBERT A. (Naval Air Propulsion Center)

FAA/CT-86/42 FAA/CT-88/21 FAA/CT-88/23

DeLUCIEN, ALBERT G. (PACER Systems Inc.)

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FAA-RD-80-107 FAA/RD-81/35

DEVORE, GILBERT (FAA, NAFEC)

NA-67-1

DINERMAN, BERNHART V. (FAA, NAFEC)

FAA-RD-71-96

EDMONDS, JACK D. (FAA Technical Center)

FAA/CT-82/57

ENIAS, JAMES H. (FAA Technical Center)

FAA/CT-TN84/16 FAA/CT-TN84/20 FAA/CT-TN85/15
FAA/CT-TN85/55 FAA/CT-TN85/58

ERIKSSON, R.H. (Pratt & Whitney)

FAA-RD-77-100

ESPOSITO, ROBERT J. (FAA Technical Center)

FAA/RD-82/8 FAA/RD-82/9 FAA/RD-82/71

EVANS, JEAN (FAA Technical Center)

FAA/CT-TN86/17

FARRELL, RUTH J. (FAA,NAFEC)

FAA-NA-81-54

FORREST, R.D. (NASA Ames Research Center)

FAA-RD-80-64

FREUND, D. JAMES (VITRO)

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FAA-RD-80-88 FAA-RD-81-59

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115-608-3X (June 1962)

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YONGMAN, D.W. (FAA, NAFEC)

115-608-3X (June 1962)

APPENDIX D: ACRONYMS

ABC	Advancing blade concept
ADF	Automatic direction finder
ADS	Automatic dependent surveillance
AM	Amplitude modulated
AMA	Analytical Mechanics Associates
ARA	Airborne RADAR Approach
ARINC	Aeronautical Radio Inc.
ATC	Air traffic control
AWOS	Automated weather observing system
AWOS GEM	AWOS generalized equivalent markov
CAA	Civil Aviation Authority (UK)
DME	Distance Measurement Equipment
E-L	Electroluminescent
EMI	Electromagnetic interference
EMS	Emergency medical service
FAA	Federal Aviation Administration
FAATC	FAA Technical Center
FLIR	Forward looking infrared radar
GEM	Generalized equivalent markov
GPS	Global positioning system
HAA	Helicopter Association of America
HAI	Helicopter Association International
HF	High frequency
IFR	Instrument flight rules

ILS	Instrument landing system
INS	Inertial navigation system
LOFF	Loran flight following
MLS	Microwave landing system
NAE	National Aeronautical Establishment
NAFEC	National Aviation Facilities Experimental Center
NASA	National Aeronautics and Space Administration
NAVSTAR	Navigation satellite timing and ranging
NDB	Nondirectional beacon
NRL	Naval Research Laboratory
NWS	National Weather Service
PAR	Precision approach radar
RNAV	Area navigation
SCT	Systems Control Technology
STOL	Short takeoff and landing
TCAS	Traffic alert and collision avoidance system
TERPS	Terminal instrument procedures
VFR	Visual flight rules
VLATME	Very light weight air traffic management equipment
VNAV	Vertical navigation
VOR	Very high frequency omnidirectional radio range
VTOL	Vertical takeoff and landing

APPENDIX E: ABSTRACTS

This report is a supplement to "FAA Helicopter/Heliport Research, Engineering, and Development - Bibliography, 1964 - 1986" (FAA/PM-86/47) published in November 1986 (NTIS accession number AD-A174697). The bibliography and the indexes contained in this report include all of what was published in the earlier document. However, Appendix E of this report does not contain any abstracts which were included in FAA/PM-86/47. Abstracts contained herein are only for those reports which have been published subsequent to the earlier bibliography plus any earlier reports which were inadvertently overlooked. Appendix E does include all the abstracts contained in an earlier supplemental bibliography, "FAA Rotorcraft Research Engineering, and Development Bibliography, 1964 - 1987" (PS-88-1-LR).

Technical Report Documentation Page

1. Report No. Project No. 115-608-3X	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle A Simulation Study of IFR Helicopter Operations in the New York Area		5. Report Date June 1962
		6. Performing Organization Code
		8. Performing Organization Report No.
7. Author(s) A.L. Sluka, J.R. Bradley, D.W. Yongman, D.A. Martin		
9. Performing Organization Name and Address Federal Aviation Administration National Aviation Facilities Center Experimental Division Atlantic City, New Jersey		10. Work Unit No. (TRAIS)
		11. Contract or Grant No.
		13. Type of Report and Period Covered Final Report
12. Sponsoring Agency Name and Address Federal Aviation Administration Systems Research and Development Service Washington, D.C.		14. Sponsoring Agency Code

15. Supplementary Notes

The Franklin Institute Laboratories were involved in the preparation of this report.

16. Abstract

The purpose of this study was to test and evaluate air traffic control procedures, separation standards, facilities, route structures, and services which would be required for helicopter instrument operations in the environmental area of New York. The simulation study conducted was not an analysis of a problem area, but rather a series of tests designed to establish a working hypothesis from which to develop procedures for accommodating instrument flight rule helicopter operations.

The simulation program was divided into two phases. In Phase I, helicopter route structures 3 and 5 statute miles in widths were designed, based on existing navigational aids. Phase I compared two methods, common controller and discrete controller concepts of delegating control responsibility for rotary wing operations. Concurrently, different control procedures were examined by which helicopters were either integrated or segregated from conventional aircraft during instrument approach and landing operations.

Phase II studies explored a modified helicopter route structure supplemented with additional aids to navigation. All other parameters evaluated in Phase II were identical to those studied in Phase I.

Results indicated that as helicopter operations increased, system efficiency was more readily maintained using the discrete controller concept under segregated conditions.

17. Key Words Helicopter Instrument flight rules (IFR) Simulation New York City	18. Distribution Statement Released to the U.S. Department of Commerce Business and Defense Service Admin. Office of Technical Service Washington 25, D.C.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	71	

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Technical Report Documentation Page

1. Report No.
RD-66-46

2. Government Accession No.
AD-643257

3. Recipient's Catalog No.

4. Title and Subtitle
VORTAC Error Analysis for Helicopter Navigation, New York City Area

5. Report Date
September 1966

6. Performing Organization Code

7. Author(s)
Ronald Braff

8. Performing Organization Report No.

9. Performing Organization Name and Address
Federal Aviation Administration
National Aviation Facilities Experimental Center
Test and Evaluation Division
Atlantic City, New Jersey

10. Work Unit No. (TRAIS)

11. Contract or Grant No.

12. Sponsoring Agency Name and Address
Federal Aviation Administration
Systems Research and Development Center
Washington, D.C.

13. Type of Report and Period Covered
Final Report

14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The purpose of this study was to determine the VORTAC station pairs that are most suitable for DME/DME helicopter navigation in the New York metropolitan area; to recommend the VORTAC station pairs to be used when flight testing the DME/DME system in the New York metropolitan area; and to analytically predict and compare DME/DME and DME/VOR navigation system performance, with respect to area coverage and track keeping ability, in the New York metropolitan area.

The DME/DME and DME/VOR system is analyzed in this study by the use of error models that are essentially of a geometric nature. Pertinent radio propagation anomalies are briefly discussed and included in the analysis.

Multipath phenomena, i.e., scalloping and roughness in the VOR and distorting echoes in the DME, are not considered in this study. Their effect on system performance can only be ascertained by flight testing in the low altitude New York metropolitan environment.

17. Key Words
Low Altitude Navigation
VORTAC
DME/DME DME/VOR
Helicopter

18. Distribution Statement
This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report)
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20. Security Classif. (of this page)
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21. No. of Pages
58

22. Price

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
RD-66-68	AD-646236	

4. Title and Subtitle V/STOL Approach System Steep Angle Flight Tests	5. Report Date January 1967 6. Performing Organization Code
7. Author(s) Glen D. Adams	8. Performing Organization Report No.
9. Performing Organization Name and Address Federal Aviation Agency National Aviation Facilities Experimental Center Test and Evaluation Division Atlantic City, N.J.	10. Work Unit No. (TRAIS) 11. Contract or Grant No.
12. Sponsoring Agency Name and Address Federal Aviation Agency System Research and Development Service Washington, D.C.	13. Type of Report and Period Covered Interim Report 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report describes results obtained during flight tests with an S-61N helicopter on the Vertical/Short Takeoff-Landing (V/STOL) Approach System (VAPS) developed by Adcole Corporation of Waltham, Massachusetts, under FAA Contract FA-WA-4582.

The system consists of a solid-state microwave localizer and glide slope operating in the 15,000 Mc/s frequency region. All ground equipment is housed within a 5-foot high radome, 4 1/2 feet in diameter. The localizer bearing and the glide slope angle can be readily changed by hand cranks at the ground station.

Fifteen hours of flight time were expended on approaches, with glide slope angle ranging from 3° to 60°.

The conclusion is reached that the S-61N helicopter approaches at angles greater than 20° encountered VAPS equipment limitations - deficient guidance signals, and aerodynamic limitations - marginal control, roughness and excessive descent rates.

17. Key Words	18. Distribution Statement
Helicopter V/STOL Precision Approachs Steep Approaches	This document is available to the U.S. public through the National Technical Information Service, Springfield, VA 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	43	

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
RD-67-36	AD-657330	

4. Title and Subtitle Economic and Technical Feasibility Analysis of Establishing An All-Weather V/STOL Transportation System	5. Report Date May 1967
	6. Performing Organization Code
7. Author(s) Joseph M. Del Balzo	8. Performing Organization Report No. RD-67-36
9. Performing Organization Name and Address Submitted in partial fulfillment of the requirements for the degree of Master of Science in Engineering Management	10. Work Unit No. (TRAIS)
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered Thesis
	14. Sponsoring Agency Code

15. Supplementary Notes

Drexel Institute of Technology, College of Engineering Graduate Studies

16. Abstract

One of the major disadvantages of today's conventional air transportation is that flights operate from airports that are typically distant from city centers, thus causing the air traveler to spend a substantial portion of his overall-trip time going to and from the airport by ground transportation. In the Washington-New York stage, for instance, ground time often exceeds air time. It has long been recognized that with aircraft having vertical flight capability, common carrier air service to the very center of congested communities would become a reality. Thus the dependence of the traveler on time consuming ground transport between the city center and its outlying airport, and between the city centers as well, would be substantially reduced. The problem to be solved by this thesis is to demonstrate that an all weather navigation capability for a V/STOL transportation system can be developed, and that such a system will result in economic benefits over and above the cost of providing the service.

17. Key Words	18. Distribution Statement
V/STOL Transportation System Low Altitude Navigation	This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	142	

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TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. FAA-NA-72-39	2. Government Accession No. AD-742849	3. Recipient's Catalog No.
4. Title and Subtitle INDEX OF NAFEC TECHNICAL REPORTS, 1967 - 1971		5. Report Date May 1972
		6. Performing Organization Code NA-64
7. Author(s) Compiled by NAFEC Library		8. Performing Organization Report No. FAA-NA-72-39
9. Performing Organization Name and Address National Aviation Facilities Experimental Center Atlantic City, New Jersey 08405		10. Work Unit No.
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address FEDERAL AVIATION ADMINISTRATION National Aviation Facilities Experimental Center Atlantic City, New Jersey 08405		13. Type of Report and Period Covered Final
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

This report is an index of all technical reports which were assigned NA numbers and published by NAFEC during the period 1967 through 1971. Entries are arranged by NA number and include titles, authors and full abstracts. Separate sections contain indexes by subject, author, RD number, DS number, project number, and contract number.

17. Key Words Reports Bibliographies	18. Distribution Statement Availability is unlimited. Document may be released to the National Technical Information Service, Springfield, Virginia 22151, for sale to the public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	106	$3.00 PC $ .95 MF

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TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. FAA-NA-72-41	2. Government Accession No. AD-746863	3. Recipient's Catalog No.
4. Title and Subtitle COLLISION AVOIDANCE: AN ANNOTATED BIBLIOGRAPHY, SEPTEMBER 1968 --- APRIL 1972		5. Report Date AUGUST 1972
		6. Performing Organization Code
7. Author(s) Dorothy E. Bulford, Compiler		8. Performing Organization Report No. FAA-NA-72-41
9. Performing Organization Name and Address National Aviation Facilities Experimental Center Atlantic City, New Jersey 08405		10. Work Unit No.
		11. Contract or Grant No.
		13. Type of Report and Period Covered Final Report 1968 - 1972
12. Sponsoring Agency Name and Address FEDERAL AVIATION ADMINISTRATION National Aviation Facilities Experimental Center Atlantic City, New Jersey 08405		14. Sponsoring Agency Code
15. Supplementary Notes None		

16. Abstract

In November 1968 a bibliography consisting of 1013 references without annotations was issued as FAA report number NA-68-54 (AD 677 942). This present work supplements that report. In addition to the Subject and Corporate Author Indexes of the 1968 listing, this bibliography includes a Personal Names Index which will help find secondary authors or locate names mentioned in titles and abstracts.

17. Key Words Collision Avoidance; Conflicts; Collision Avoidance Systems; Air Traffic Control; Mid-Air Collisions; Near Misses; Pilot Warning Indicator; Proximity Warning System; Separation	18. Distribution Statement Availability is unlimited. Document may be released to the National Technical Information Service, Springfield, Virginia, 22151, for sale to the public.

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1. Report No. FAA-EM-73-8	2. Government Accession No. AD-766900	3. Recipient's Catalog No.
4. Title and Subtitle CIVIL AVIATION MIDAIR COLLISIONS ANALYSIS JANUARY 1964 - DECEMBER 1971		5. Report Date May 1973
		6. Performing Organization Code D-43
7. Author(s) T. R. Simpson, R. A. Rucker, J. P. Murray		8. Performing Organization Report No. MTR-6334
9. Performing Organization Name and Address The MITRE Corporation McLean, Virginia 22101		10. Work Unit No.
		11. Contract or Grant No. DOT-FA70WA-2448
12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Administration Office of Systems Engineering Management Washington, D.C. 20591		13. Type of Report and Period Covered
		14. Sponsoring Agency Code DOT/FAA
15. Supplementary Notes		

16. Abstract

The study analyzes all midair collisions which occurred within the 48 states over the eight year period, Jan. 64 - Dec. 71. It develops statistical, graphical, and narrative information which is used to assess the efectiveness of the ATC system in preventing midair collisions, to identify remaining problem areas amenable to systematic solutions, and to compare these findings with several proposed solutions for reducing collision risks.

The study shows that no midair collisions occurred when both aircraft were identified and under radar/beacon surveillance, under positive control, and both pilots conformed to their ATC clearances. Only one midair occurred at an airport where the local controller was equipped with a radar BRITE display of local traffic. Most fatalities resulted from midair collisions which occurred beyond 5 miles of any airport, but within 30 miles of a major hub airport and resulted from collisions between an IFR air carrier and an unknown VFR aircraft. Nearly all midair collisions at airports occurred at the very busy airports where the pilot had the prime responsibility for successful sequencing into the VFR traffic pattern. Collisions at the busier uncontrolled airports are shown to be linearly related to annual aircraft operations; while collisions at the busier controlled airports are shown to be non-linearly related to annual aircraft operations, being approximately square-law for non-radar VFR towers.

17. Key Words Midair Collisions, Aircraft Accidents, Air Traffic Control, Collision Avoidance Systems, Proximity Warning Indicators, Aviation Fatalities, Radar/Beacon Surveillance.	18. Distribution Statement Unlimited availability. Document may be released to the National Technical Information Service, Springfield, Virginia, 22151, for sale to the public.

19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 203	22. Price

Form DOT F 1700.7 (8-69)

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FAA-EM-73-8 Addendum 1	AD-A005897	

4. Title and Subtitle	5. Report Date
CIVIL AVIATION MIDAIR COLLISIONS ANALYSIS 1972 Added to 1964-71 Results	December 1974
	6. Performing Organization Code: D-43
7. Author(s): R. A. Rucker, T. R. Simpson	8. Performing Organization Report No.: MTR-6334, Supplement 1
9. Performing Organization Name and Address: The MITRE Corporation, 1820 Dolley Madison Blvd., McLean, Virginia 22101	10. Work Unit No. (TRAIS)
	11. Contract or Grant No.: DOT-FA70WA-2448
12. Sponsoring Agency Name and Address: Office of Systems Engineering Management, Department of Transportation, Federal Aviation Administration, Washington, D.C. 20591	13. Type of Report and Period Covered: FINAL
	14. Sponsoring Agency Code: DOT/FAA

15. Supplementary Notes

16. Abstract This study updates the cumulative results of the previous 1964-71 study to include the 25/47 collisions/fatalities which occurred during 1972. Of these, two collisions involved air carrier aircraft and accounted for 23 fatalities. The remaining 23/24 collisions/fatalities occurred between general aviation aircraft, and did not involve public air transportation.

Included is an analysis of the potential effectiveness of alternative collision avoidance systems coverage in "preventing" a recurrence of the 296/603 collisions/fatalities between 1964-72. It concludes that 26% of the collisions (6% of fatalities) are systematically unpreventable. The currently existing/planned extensions to the ATC system could have prevented 18% of the collisions (51% of fatalities), including all fatal collisions which involved air carriers. An additional 44% of the collisions (35% of fatalities) occurred within existing/planned beacon surveillance coverage and might have been prevented by either Discrete Address Beacon System/Intermittent Positive Control (DABS-IPC), or by an independent Collision Avoidance System (CAS). An additional 12% of the collisions (8% of fatalities) occurred below existing/planned beacon surveillance coverage and might have been prevented by a CAS Only system without a coverage limitations. However, with the added/planned extensions of the ATC system, a CAS/CAD* system under the proposed legislation might have prevented only an additional 4% of either collisions or fatalities. This is because most collisions are between aircraft under 12,500 lbs. and both would be CAD*, not CAS equipped. These figures represent theoretical upper bounds on preventability.

*Collision Avoidance Device ("Here I am" device).

17. Key Words	18. Distribution Statement
Midair Collisions, Aircraft Accidents, Air Traffic Control, Collision Avoidance Systems, Proximity Warning Indicators, Aviation Fatalities, Radar/Beacon Surveillance.	Unlimited availability. Document may be released to the National Technical Information Service, Springfield, Virginia, 22151, for sale to the public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified		$3.00 PC .95 MF

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Technical Report Documentation Page

1. Report No. FAA RD-76-100 NASA TM X-73,124	2. Government Accession No. AD-A028058	3. Recipient's Catalog No.
4. Title and Subtitle PROGRESS TOWARD DEVELOPMENT OF CIVIL AIRWORTHINESS CRITERIA FOR POWERED-LIFT AIRCRAFT		5. Report Date May 1976
		6. Performing Organization Code
		8. Performing Organization Report No.
7. Author(s) Barry C. Scott (FAA), Charles S. Hynes (NASA) Paul W. Martin (FAA), Ralph B. Bryder (CAA)		
9. Performing Organization Name and Address Federal Aviation Admin., Moffett Field, Calif., and Los Angeles, Calif.; National Aeronautics and Space Admin. Ames Research Center, Moffett Field, Calif.; Civil Aviation Authority, Great Britain.		10. Work Unit No. (TRAIS)
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration Systems Research and Development Service Washington, D.C. 20590	National Aeronautics and Space Admininstration Ames Research Center Moffett Field, Calif. 94035	13. Type of Report and Period Covered Final
		14. Sponsoring Agency Code ARD-500
15. Supplementary Notes		

16. Abstract

This report summarizes the results of a joint NASA-FAA research program directed toward development of civil airworthiness flight criteria for power-lift transports. Tentative criteria are proposed for performance and handling characteristics for powered-lift transport aircraft in commercial service. The aircraft considered are primarily wing-supported vehicles which rely upon the propulsion system for a significant portion of lift and control. VTOL aircraft are excluded. The flight criteria treat primarily the approach and landing flight phases, because it is in these flight phases that the greatest use of powered lift is made, and the greatest differences from conventional aircraft tend to appear. Consequently, the flight task tends to become most demanding. The tentative criteria are based on simulation and flight experience with a variety of powered-lift concepts. These concepts have not employed flight director, advanced displays, or advanced augmentation systems. The tentative criteria proposed were formulated by a working group comprised of representatives of the U.S., British, French, and Canadian airworthiness authorities, as well as research personnel of the NASA and other organizations. It is recognized that more work is needed to assure general applicability of the criteria.

17. Key Words Short Takeoff and Landing (STOL) Powered Lift Airworthiness Criteria Aircraft		18. Distribution Statement This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.	
19. Security Classif. (of this report) UNCLASSIFIED	20. Security Classif. (of this page) UNCLASSIFIED	21. No. of Pages 74	22. Price

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Technical Report Documentation Page

1. Report No.
FAA-EM-77-15

2. Government Accession No.
AD-A049879

3. Recipient's Catalog No.

4. Title and Subtitle
Bibliography: Airports

5. Report Date
October 1977

6. Performing Organization Code
SB01

7. Author(s)

8. Performing Organization Report No.

9. Performing Organization Name and Address
Transportation Research Board
Commission on Sociotechnical Systems
National Academy of Sciences
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

10. Work Unit No. (TRAIS)

11. Contract or Grant No.
DOT FA76WA-3872

12. Sponsoring Agency Name and Address
Federal Aviation Administration
U.S. Department of Transportation
Washington, D.C. 20591

13. Type of Report and Period Covered
Bibliography

14. Sponsoring Agency Code

15. Supplementary Notes
A prototype product of the Air Transportation Research Information Service

16. Abstract

This bibliography was prepared to illustrate input-output procedures that have been proposed for the implementation of an Air Transportation Research Information Service (ATRIS). The proposed subject scope for ATRIS covers 21 areas that range from *aircraft* to *travel* and *tourism*. The subject of *airports* was selected as the area for initial input to the ATRIS data base from which this bibliography has been produced. The bibliography has 10 chapters on major aspects of airports, including access, environmental impact, planning and design, safety and security, operations, and management. The bibliography contains nearly 800 references that represent initial input to the machine-readable ATRIS data base. The implementation plan calls for extending the data base to full coverage of all subject areas and to provide both on-line and off-line services to the air transport community.

Many of the references were acquired from data bases held by National Aeronautics and Space Administration, National Technical Information Service, Engineering Index, and other information services. Other references were prepared from documents held by various libraries and transportation centers. Selections were made by staff of the Flight Transportation Laboratory at Massachusetts Institute of Technology; final input and output processing was performed by Transportation Research Board information staff.

A major purpose for the bibliography is to inform ATRIS users of the services that might be provided and through feedback from recipients of the bibliography to learn more about the needs and wants of users of air transport information.

17. Key Words

Airports	Planning	Access
Policy	Finance	Capacity
Forecasting	Economics	Operations
Demand	Regulation	Safety
Environment	Airside	Security
Management	Design	

18. Distribution Statement
Unlimited availability. Document may be released to the National Technical Information Service, Springfield, Virginia, 22161, for sale to the public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	154	

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FAA-NA-81-54	AD-A104759	
4. Title and Subtitle INDEX OF NAFEC TECHNICAL REPORTS, 1972 - 1977		5. Report Date May 1981 6. Performing Organization Code
7. Author(s) Compiled by Ruth J. Farrell Edited by Nancy G. Boylan		8. Performing Organization Report No. FAA-CT-81-54
9. Performing Organization Name and Address Federal Aviation Administration Technical Center Atlantic City Airport, New Jersey 08405		10. Work Unit No. (TRAIS) 11. Contract or Grant No. 999-113-000
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration Technical Center Atlantic City Airport, New Jersey 08405		13. Type of Report and Period Covered Final 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report is an index of all technical reports which were assigned NA numbers and published by NAFEC during the period 1972 through 1977. Entries are arranged by NA number and include titles, authors and full abstracts. Separate sections contain indexes by subject, author, and RD number.

17. Key Words	18. Distribution Statement
Reports Bibliographies	Document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	199	

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/CT-82/143	AD-A123537	

4. Title and Subtitle	5. Report Date
SAFETY BENEFITS ANALYSIS OF GENERAL AVIATION COCKPIT STANDARDIZATION	December 1982
	6. Performing Organization Code
7. Author's	8. Performing Organization Report No.
Bruce E. Beddow, Sidney Berger, Charles E. Roberts, Jr.	
9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Kappa Systems, Inc. 1501 Wilson Boulevard Arlington, Virginia 22209	11. Contract or Grant No. DTFA03-81-C-00058
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
U.S. Department of Transportation Federal Aviation Administration Atlantic City Airport, New Jersey 08405	Final June 1981 - September 1982
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The purpose of this study was to assess the societal benefits that may be gained by implementation of cockpit standardization as a countermeasure to fuel mismanagement accidents and accidents involving improper operation of the powerplant and powerplant controls. The benefits are expressed as the costs of accidents which could be prevented by standardization. Detailed analyses were performed on a sample of 200 accident cases drawn from the National Transportation Safety Board files which contain 2,011 accidents in the period 1975-1979 due to the specified causes. The flight environment, aircraft and pilot characteristics, and their interrelation were fully considered in studies of accident causes. The accident pilot-group which contained many high time pilots with advanced certificates was found less qualified with regard to recent night flying and instrument flight time. Fuel systems for all makes and model aircraft of the sample were found to contain great diversity in location of components and operating modes. Powerplant controls are not as diverse in design but still do not conform totally to recommended optimization guidelines. Preventability is determined by identification of all elemental pilot errors in an accident and overlaying these on an application of standardization guidelines applied to the controls, instruments, and arrangements. Average accident costs are determined by a severity index breakdown and then carefully extrapolated to the full accident data base. Cumulative accident cost reductions are found for a 10-year future period. A proposal for alleviating the pilot non-familiarity with specific makes and models is included. In this area, an advisory approach is found preferable to certification and rating structural changes.

17. Key Words	18. Distribution Statement
Mismanagement of fuel Improper operation of powerplant Pilot error Cockpit standardization Pilot restriction	Document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	114	

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-FAA-CT-82-152	AD-A131696	

4. Title and Subtitle	5. Report Date
Review of Aircraft Crash Structural Response Research	August 1982
	6. Performing Organization Code
	8. Performing Organization Report No.
7. Author(s) Emmett A. Witmer and David J. Steigmann	ASRL TR 198-1
9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Aeroelastic and Structures Research Laboratory Department of Aeronautics and Astronautics Massachusetts Institute of Technology Cambridge, Massachusetts 02139	11. Contract or Grant No. F33615-77-C-5155, Task P00010
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
U.S. Department of Transportation Federal Aviation Administration Technical Center Atlantic City, New Jersey 08405	Final August 1981-August 1982
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

A review of aircraft crash structural response research has been carried out by studying the literature, discussions with researchers working in that area, and visits to facilities/personnel involved in conducting and/or monitoring aircraft crash structural response investigations. Aircraft structures consisting of conventional built-up metallic construction and those consisting of advanced composite materials were of interest. The latter type of materials and construction is of particular interest since their use is expanding rapidly, and crashworthiness of such structures is of increasing importance.

Some recent theoretical and experimental studies of the behavior of composite-material structures subjected to severe static, dynamic, and/or impact conditions are noted. Such topics as crashworthiness testing of composite fuselage structures, the impact resistance of graphite and hybrid configurations, and the effects of elastomeric additives on the mechanical properties of epoxy resin and composite systems are reviewed.

The principal theoretical methods for predicting the nonlinear transient structural responses of severely loaded structures are reviewed. Available lumped-mass and finite-element computer programs tailored to aircraft crash response analysis are noted.

A review is made of some current and planned research to investigate experimentally the mechanical failure, postfailure, and energy-absorbing behavior of a sequence of composite-material structural elements and structural assemblages subjected to static loads or to simulated crash-impact loads.

17. Key Words	18. Distribution Statement
Crash Impact, Fiber-Reinforced Plastics, Crashworthiness, Experiments, Aircraft, Simulation Models, Structural Dynamics, Composites	Document is available to the U.S. public through the National Technical Information Service, Springfield, Va. 22161.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	136 ~~133~~	

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Technical Report Documentation Page

1. Report No. DOT/FAA/CT-85/7	2. Government Accession No. AD-A168 820	3. Recipient's Catalog No.
4. Title and Subtitle State-Of-The-Art Review On Composite Material Fatigue/Damage Tolerance		5. Report Date December 1985
		6. Performing Organization Code FAA-84-03
7. Author(s) Reginald L. Amory, David S. Wang		8. Performing Organization Report No. FAA-84-03-F
9. Performing Organization Name and Address B & M Technological Services, Inc. 222 Third Street Cambridge, MA 02142		10. Work Unit No. (TRAIS)
		11. Contract or Grant No. DTFA03-84-C-00052
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration Technical Center Atlantic City Airport, NJ 08405		13. Type of Report and Period Covered FINAL REPORT July 1984 - November 1984
		14. Sponsoring Agency Code ACT-330
15. Supplementary Notes		

16. Abstract

A state-of-the-art review on composite material fatigue/damage tolerance was conducted to investigate the literature for fatigue life prediction methodologies including stress-based methodologies, strength degradation models, and damage growth models. A critical review was made of each methodology and its commensurate basic equations of importance. Experimental data were reviewed and the behavior of specimens was correlated with that of civil aircraft components. The report also examined the six recognized methods for the non-destructive testing of fibrous composite materials and identified the most effective methods.

17. Key Words: Fatigue; Composite Materials; Fatigue Life; Fatigue/Damage; Composite Civil Aircraft; Stress-Based; Strength Degradation; Damage Growth	18. Distribution Statement: This document is available to the U.S. public through the National Technical Information Service, Springfield, VA 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	75	

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TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/PM-85/29	AD-A181349	

4. Title and Subtitle
Traffic Alert and Collision Avoidance System (TCAS)
Surveillance Performance in Helicopters

5. Report Date
8 May 1987

6. Performing Organization Code

7. Author(s)
William H. Harman, III, Jerry D. Welch, and M. Loren Wood, Jr.

8. Performing Organization Report No.
ATC-135

9. Performing Organization Name and Address
Lincoln Laboratory, MIT
P.O. Box 73
Lexington, MA 02173-0073

10. Work Unit No. (TRAIS)

11. Contract or Grant No.
DOT-FA77WAI-817

12. Sponsoring Agency Name and Address
Department of Transportation
Federal Aviation Administration
Systems Research and Development Service
Washington, DC 20591

13. Type of Report and Period Covered
Project Report

14. Sponsoring Agency Code

15. Supplementary Notes

The work reported in this document was performed at Lincoln Laboratory, a center for research operated by Massachusetts Institute of Technology, under Air Force Contract F19628-85-C-0002.

16. Abstract

Subsequent to the development of TCAS equipment for fixed-wing aircraft, a follow-on effort addressed the suitability of such equipment for use in helicopters. This program focused on those differences between helicopters and fixed-wing aircraft that might be expected to affect TCAS performance: the large rotor, the relatively irregular shape of the fuselage, the low speeds and high turn rates typical of helicopter flights, and the over-water and low-altitude conditions typical of helicopter operations. A Bell Long Ranger helicopter was acquired and equipped with experimental TCAS equipment with full data recording capability. Flight experiments were conducted to assess air-to-air surveillance performance under challenging conditions. Other flights involved guest pilots for subjective evaluations of the TCAS performance. It was concluded that the air-to-air surveillance techniques that were originally developed for use in large jet airliners will also perform satisfactorily in helicopters. The bearing accuracy of traffic advisories, while somewhat degraded because of the effects of the rotor and the shape of the helicopter fuselage, will nevertheless be sufficient to aid the pilot in visual acquisition of traffic. It was also concluded that, because of the flight characteristics of helicopters, the pilot display should consist of traffic advisories alone, without resolution advisories.

17. Key Words
TCAS
Collision avoidance
Helicopters
Pilot
Angle-of-arrival

18. Distribution Statement
Document is available to the public through the National Technical Information Service, Springfield, VA 22161.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/CT-TN85/43		

4. Title and Subtitle	5. Report Date
HELICOPTER MLS RNAV DEVELOPMENT AND FLIGHT TEST PROJECT, PROJECT PLAN	October 1985
	6. Performing Organization Code: ACT-140
7. Author(s): James H. Remer	8. Performing Organization Report No.: DOT/FAA/CT-TN85/43
9. Performing Organization Name and Address: Federal Aviation Administration Technical Center Atlantic City Airport, New Jersey 08405	10. Work Unit No. (TRAIS)
	11. Contract or Grant No.: T0701G
12. Sponsoring Agency Name and Address: Federal Aviation Administration Program Engineering and Maintenance Service Washington, DC 20590	13. Type of Report and Period Covered: Technical Note July 1985
	14. Sponsoring Agency Code: APM-450

15. Supplementary Notes

16. Abstract

This Technical Note encompasses a plan for the Helicopter Microwave Landing System Area Navigation Project (MLS RNAV). The initial goal of this project is to develop the capability to execute single segment approaches at random orientations within the terminal area coverage of the MLS. Hardware and software development plans are included, along with associated schedules and candidate flight profiles.

17. Key Words	18. Distribution Statement
Microwave Landing System (MLS) Area Navigation (RNAV) Helicopter	Document is on file at the Technical Center Library, Atlantic City Airport, New Jersey 08405

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	23	

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1. Report No. DOT/FAA/CT-86/8	2. Government Accession No. AD-A182744	3. Recipient's Catalog No.
4. Title and Subtitle Determination of Electrical Properties of Grounding, Bonding, and Fastening Techniques for Composite Materials		5. Report Date April 1987
		6. Performing Organization Code
7. Author(s) William W. Cooley		8. Performing Organization Report No.
9. Performing Organization Name and Address Science and Engineering Associates, Inc. 701 Dexter Avenue North, Suite 400 Seattle, WA 98109		10. Work Unit No. (TRAIS)
		11. Contract or Grant No. DTFA03-84-C-00065
12. Sponsoring Agency Name and Address Federal Aviation Agency Technical Center Atlantic City International Airport, NJ 08405		13. Type of Report and Period Covered Final Technical Report September '84-December '85
		14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report documents the results from a limited study of Electrical Parameters of Composite Materials. These efforts provided an evaluation of grounding and bonding test methods for metal, metal honeycomb, and advanced composite materials. A review of the electrical currents in the bonding and grounding paths on aircraft concluded that the lightning environment is the most severe followed by power system faults and on-board HF radio. It is recommended that the conventional 2.5 milliohm grounding and bonding requirement may be relaxed providing that special tests are conducted on the structure and subassemblies that enter into the grounding and bonding current paths. These tests are defined and recommendations made for advanced structures. A limited analysis of published test results concluded that good agreement may be possible between predicted values and test results for complete structures, subassemblies, and components.

17. Key Words Composite Materials; EMI; Lightning; Electrical Parameters; Grounding; Bonding		18. Distribution Statement This document is available through the National Technical Information Service Springfield, Virginia 22161	
19. Security Class. (of this report) Unclassified	20. Security Class. (of this page) Unclassified	21. No. of pgs.	22. Price

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/CT-86/24	AD-A180472	

4. Title and Subtitle	5. Report Date
STUDY OF GENERAL AVIATION FIRE ACCIDENTS (1974-1983)	February 1987
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Ludwig Benner, Jr., Richard Clarke, Russell Lawton	
9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Events Analysis, Inc. 12101 Toreador Lane Oakton, Virginia 22124	11. Contract or Grant No. DTFA03-85-C-00018
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
FAA Technical Center Atlantic City Airport, New Jersey 08405	FINAL REPORT
	14. Sponsoring Agency Code ACT-350

15. Supplementary Notes

16. Abstract

This report describes a study of fires and interior materials in General Aviation (GA) aircraft during 1974-1983. The purpose of the study was to learn trends in GA fires and the materials used in aircraft interiors. The study covered aircraft of less than 12,501 pounds gross weight, not in commercial or agricultural operations.

Fires are a minor part of GA accident experience. Accident data yielded 2,351 post impact fires having 798 fatalities. These accidents were 6 percent of the total of 36,130 GA accidents. Only 153 inflight fires occurred during the period from 1974-1983. The GA fire population closely resembled the entire GA aircraft population. One difference was that fatalities and aircraft damage increased with higher approach speeds and gross weights up to 10,500 pounds. Also, the proportion of fire accidents and fatalities was greater in low than in the more common high wing aircraft. For inflight fires, the aircraft engine was the major fire origin for twin- and single-engine aircraft. Only in single-engine aircraft was the instrument panel a source of inflight fires.

Data on the 20 most common GA aircraft disclosed conventional materials, similar to those used in the home. Polyurethane foam cushioning, wool and nylon fabrics, ABS plastic and aluminum typify the materials used in these aircraft.

17. Key Words	18. Distribution Statement
Aircraft Fires General Aviation Accident Data	Document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	75	

Form DOT F 1700.7 (8-72)

Technical Report Documentation Page

1. Report No. DOT/FAA/CT-TN86/24	2. Government Accession No. AD-A 176040	3. Recipient's Catalog No.
4. Title and Subtitle ROTORCRAFT TCAS EVALUATION GROUP 2 RESULTS		5. Report Date July 1986
		6. Performing Organization Code ACT-140
7. Author(s) Albert J. Rehmann		8. Performing Organization Report No. DOT/FAA/CT-TN86/24
9. Performing Organization Name and Address U.S. Department of Transportation Federal Aviation Administration Technical Center Atlantic City Airport, New Jersey 08405		10. Work Unit No. (TRAIS)
		11. Contract or Grant No. T11-01B
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration Program Engineering and Maintenance Service Washington, D.C. 20590		13. Type of Report and Period Covered Technical Note October - November 1985
		14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The results of antenna and surveillance testing are described in this report. Two Traffic Alert and Collision Avoidance System (TCAS) antenna sites were chosen for the Sikorsky S-76, and both proved suitable for a single antenna installation. The particular effects of helicopter operation on existing TCAS surveillance were examined. Recommended changes will be tested following Group 3 flight tests.

17. Key Words Collision Avoidance Mid-Air Collisions Rotorcraft TCAS	18. Distribution Statement This document is available to the U.S. public through the National Technical Information Service, Springfield, Va. 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	60	

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Technical Report Documentation Page

1. Report No. DOT/FAA/CT-TN86/30	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle EVALUATION OF MLS FOR HELICOPTER OPERATIONS OPTIMUM COURSE WIDTH TAILORING FLIGHT TEST PLAN		5. Report Date July 1986 6. Performing Organization Code ACT-140
7. Author(s) Michael M. Webb		8. Performing Organization Report No. DOT/FAA/CT-TN86/30
9. Performing Organization Name and Address U.S. Department of Transportation Federal Aviation Administration Technical Center Atlantic City Airport, N.J. 08405		10. Work Unit No. (TRAIS) 11. Contract or Grant No. T0701B
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration Program Engineering and Maintenance Service Washington, D.C. 20590		13. Type of Report and Period Covered Test Plan 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This flight test plan describes the methodology to determine the optimum azimuth course tailoring for microwave landing system (MLS) approaches to a collocated MLS installation at a heliport. The flight tests will be conducted at the Federal Aviation Administration (FAA) Technical Center, Atlantic City Airport, New Jersey, using the Sikorsky S-76 helicopter.

This effort will examine the feasibility of using course tailoring as a means to reduce pilot workload associated with conducting MLS approaches to minimums within 2,500 feet (range) of the guidance signal source. The test development, test equipment, data collection, and data reduction and analysis of the flight data are discussed. A schedule for the completion of the associated tasks is presented.

17. Key Words Microwave Landing System (MLS) Helicopter Heliport	18. Distribution Statement Document is on file at the Technical Center Library, Atlantic City Airport New Jersey 08405

19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 19	22. Price

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REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution is unlimited. Government Accession No. AD-A180863
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
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11. TITLE (Include Security Classification) An Analytical Study of Icing Similitude for Aircraft Engine Testing	

12. PERSONAL AUTHOR(S)	Bartlett, C. Scott, Sverdrup Technology, Inc., AEDC Group
13a. TYPE OF REPORT	Final
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18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
aircraft icing, ice scaling, icing tests, engine icing, ice accretion, icing environment, icing similitude, ice scaling laws

19. ABSTRACT (Continue on reverse if necessary and identify by block number) An analytical study was conducted of the requirements for achieving similitude for icing as test conditions were varied. The application is aimed at engine icing tests conducted in ground spray rig facilities. The analysis considers the changes in the icing test conditions, including static temperature, static pressure, liquid water content, droplet size, and flow velocity, that are required to achieve similitude if any of the conditions are changed. The analysis uses a math model of icing scaling which has been validated by experimental data collected at the AEDC icing research tunnel. The requirements for similitude were analyzed for changes in both temperature and pressure. Expressions to describe the influence of test condition changes on the value of the scaling parameter were developed. The effect of icing caused by free-stream static temperature changes and temperature rise through a generic high-bypass turbofan engine was studied. The icing test points listed for compliance testing for aircraft icing certification under guidelines given in the Federal Aviation Administration Advisory Circular (AC) 20-73 were used as test points for the analyses.

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Technical Report Documentation Page

1. Report No. DOT/FAA/CT-TN86/40	2. Government Accession No. AD-A178389	3. Recipient's Catalog No.
4. Title and Subtitle SIGNAL COVERAGE AND CHARACTERISTICS OF THE ATLANTIC CITY HELIPORT MLS		5. Report Date November 1986
		6. Performing Organization Code ACT-140
7. Author(s) Barry R. Billmann, Donald Gallagher, Christopher Wolf, John Morrow, Scott Shollenberger and Paula Maccagnano		8. Performing Organization Report No. DOT/FAA/CT-TN86/43
9. Performing Organization Name and Address Federal Aviation Administration Technical Center Atlantic City International Airport, New Jersey 08405		10. Work Unit No. (TRAIS)
		11. Contract or Grant No. T0701F
12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Administration Program Engineering and Maintenance Service Washington, D.C. 20590		13. Type of Report and Period Covered Technical Note September 1986
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

During the late fall of 1985 and the winter of 1986 test flights were conducted at the Federal Aviation Administration (FAA) Technical Center's Heliport at Atlantic City International Airport, N.J. The purpose of these flights was to verify signal coverage of the Microwave Landing System (MLS) collocated at the heliport. Other activities included the measurement of the signal characteristics of the Hazeltine Model 2400 MLS which was installed at the heliport. Elevation and azimuth course widths were determined and, using classical Z transform techniques, statistical estimates of control motion noise and path following error were obtained. These estimates were compared with the FAA Standard for Interoperability and Performance Requirements of MLS.

Results obtained were excellent. Tolerance limits were consistently met. The data revealed that wide beam width antenna systems when installed at heliports can meet specification tolerances contained in the FAA specification for MLS Interoperability and Performance Requirements.

17. Key Words Microwave Landing System (MLS) Signal Characteristics Coverage Path Following Error (PFE) Control Motion Noise (CMN) Collocated MLS	18. Distribution Statement This document is available to the U.S. public through the National Technical Information Service, Springfield, Va. 22161

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/CT-86/42	AD-A181930	

4. Title and Subtitle
STATISTICS ON AIRCRAFT GAS TURBINE ENGINE ROTOR FAILURES THAT OCCURRED IN U.S. COMMERCIAL AVIATION during 1981.

5. Report Date
March 1987

6. Performing Organization Code
PE32

7. Author(s)
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8. Performing Organization Report No.
NAPC-PE-154C

9. Performing Organization Name and Address
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PC Box 7176
Trenton, NJ 08628-0176

10. Work Unit No. (TRAIS)

11. Contract or Grant No.
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12. Sponsoring Agency Name and Address
Department of Transportation
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Technical Center
Atlantic City International Airport, NJ 08405

13. Type of Report and Period Covered

14. Sponsoring Agency Code
ACT-320

15. Supplementary Notes
PROJECT MANAGER: B. C. Fenton Engine/Fuel Safety Branch, ACT-320
Federal Aviation Administration Atlantic City International Airport, NJ 08405
Technical Center

16. Abstract

This report presents statistical information relating to gas turbine engine rotor failures which occurred during 1981 in commercial aviation service use. The predominant failure involved blade fragments, 83 percent of which were contained. Three disk failures occurred and all were uncontained. Fifty-seven percent of the 136 failures occurred during the takeoff and climb stages of flight.

This service data analysis is prepared on a calendar year basis and published yearly. The data is useful in support of flight safety analysis, proposed regulatory actions, certification standards and cost benefit analysis.

17. Key Words
Air Transportation
Aircraft Hazards
Aircraft Safety
Gas Turbine Engine Rotor Failures
Containment

18. Distribution Statement
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19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/CT-TN86/42		

4. Title and Subtitle	5. Report Date
HELICOPTER MLS DECELERATING TEST PLAN	November 1986
	6. Performing Organization Code: ACT-140
7. Author(s): Scott Shollenberger and Barry Billmann	8. Performing Organization Report No.: DOT/FAA/CT-TN86/42
9. Performing Organization Name and Address: Department of Transportation, Federal Aviation Administration, Technical Center, Atlantic City International Airport, N.J. 08405	10. Work Unit No. (TRAIS)
	11. Contract or Grant No.: T0701P
12. Sponsoring Agency Name and Address: Department of Transportation, Federal Aviation Administration, Program Engineering and Maintenance Service, Washington, D.C. 20590	13. Type of Report and Period Covered: Technical Note, November 1986
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This series of tests are designed to identify limits for Distance Measurement Equipment/Precision (DME/P) equipment installed on helicopters flying decelerating approach profiles. The tests are designed to determine the deceleration limits that can be obtained when DME/P is used to derive range and range rate.

17. Key Words	18. Distribution Statement
MLS Colocated MLS Heliport DME/P Decelerating Approaches	Document is on file at the Technical Center Library, Atlantic City International Airport, New Jersey 08405

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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Technical Report Documentation Page

1. Report No. DOT/FAA/PM-86/47	2. Government Accession No. AD-A174697	3. Recipient's Catalog No.
4. Title and Subtitle FAA Helicopter/Heliport Research, Engineering, and Development Bibliography, 1964 - 1986		5. Report Date November 1986
		6. Performing Organization Code
7. Author(s) Robert D. Smith		8. Performing Organization Report No. APM-450
9. Performing Organization Name and Address Federal Aviation Administration Program Engineering and Maintenance Service Helicopter Program, APM-450 Washington, D.C. 20591		10. Work Unit No. (TRAIS)
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address Federal Aviation Administration Program Engineering and Maintenance Service Helicopter Program, APM-450 Washington, D.C. 20591		13. Type of Report and Period Covered Final Report
		14. Sponsoring Agency Code APM-450
15. Supplementary Notes		

16. Abstract

This report is a bibliography of FAA helicopter and heliport related documents published in the 1964-1986 time period. The list is limited to documents in which the research, engineering, and development elements of the FAA were involved as sponsors, participants, or authors.

This bibliography contains abstracts and indexes on 133 technical reports.

17. Key Words Helicopter Heliport Bibliograph	18. Distribution Statement This document is available to the public through the National Technical Information Service, Springfield, Virginia 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/PM-86/52	AD-A179296	

4. Title and Subtitle THE OPERATIONAL SUITABILITY OF THE AUTOMATED WEATHER OBSERVING SYSTEM (AWOS) AT HELIPORTS	5. Report Date Februrary 1987
	6. Performing Organization Code ACT-140
7. Author(s) Rene A. Matos and Rosanne M. Weiss	8. Performing Organization Report No. DOT/FAA/CT-87/3
9. Performing Organization Name and Address Department of Transportation Federal Aviation Administration Technical Center Atlantic City International Airport, N.J. 08405	10. Work Unit No. (TRAIS) 11. Contract or Grant No. T0705A
12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Administration Program Engineering and Maintenance Service Washington, D.C. 20590	13. Type of Report and Period Covered Final Report October 1986 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

A questionnaire, based on an OPM-approved questionnaire, was distributed to pilots and users who were involved in the project, The Siting, Installation, and Operational Suitability of the Automated Weather Observing System (AWOS) at Heliports. This report documents the conclusions of the questionnaire analysis and provides basis for the determination of operational suitability of AWOS at heliports.

17. Key Words	18. Distribution Statement
Automated Weather Observing System (AWOS) Helicopter Heliport Aviation Weather Observations	This Document is Available to the U.S. Public Through the National Technical Information Service, Springfield, VA 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/CT-TN86/56	AD-A182152	

4. Title and Subtitle
LORAN C VNAV APPROACHES TO THE TECHNICAL CENTER HELIPORT

5. Report Date
March 1987

6. Performing Organization Code
ACT-140

7. Author(s)
Michael Magrogan

8. Performing Organization Report No.
DOT/FAA/CT-TN86/56

9. Performing Organization Name and Address
Department of Transportation
Federal Aviation Administration
Technical Center
Atlantic City International Airport, N.J. 08405

10. Work Unit No. (TRAIS)

11. Contract or Grant No.
T0701D

12. Sponsoring Agency Name and Address
Department of Transportation
Federal Aviation Administration
Program Engineering and Maintenance Service
Washington, D.C. 20590

13. Type of Report and Period Covered
Technical Note
March 1987

14. Sponsoring Agency Code
APM-450

15. Supplementary Notes

16. Abstract

This report documents the results of Loran C vertical navigation (VNAV) approaches to the Federal Aviation Administration (FAA) Technical Center Heliport. Results of this study show that the three dimensional (3D) Loran C Navigator met the requirements of Advisory Circular (AC) 90-45A for two dimensional (2D) error components of total system crosstrack (TSCT) and flight technical error (FTE). In addition, the 3D error component of vertical flight technical error (VFTE) met the requirements of AC 90-45A.

17. Key Words
Heliport
Loran C
Vertical Navigation (VNAV)
3D Loran C Navigator

18. Distribution Statement
This document is available to the U.S. public through the National Technical Information Service, Springfield, Va. 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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Technical Report Documentation Page

1. Report No. DOT/FAA/CT-TN86/61	2. Government Accession No. AD-A179897	3. Recipient's Catalog No.
4. Title and Subtitle HELIPORT VISUAL APPROACH SURFACE TESTING TEST PLAN		5. Report Date February 1987
		6. Performing Organization Code ACT-140
7. Author(s) Rosanne M. Weiss and John R. Sackett		8. Performing Organization Report No. DOT/FAA/CT-TN86/61
9. Performing Organization Name and Address U.S. Department of Transportation Federal Aviation Administration Technical Center Atlantic City International Airport, N.J. 08405		10. Work Unit No. (TRAIS)
		11. Contract or Grant No. T0701R
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration Program Engineering and Maintenance Service Washington, D.C. 20590		13. Type of Report and Period Covered Technical Note February 1987
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

This Technical Note identifies procedures to be used during tests to be conducted at the Federal Aviation Administration Technical Center. These tests are designed to test the applicability of existing heliport approach and departure surface criteria. Three different types of aircraft will be used.

17. Key Words VMC Approach Surfaces Heliport Helicopter Clear Surfaces	18. Distribution Statement This document is available to the U.S. public through the National Technical Information Service, Springfield, Va. 22161

19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 32	22. Price

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Technical Report Documentation Page

1. Report No. DOT/FAA/CT-TN86/63	2. Government Accession No.	3. Recipient's Catalog No.

4. Title and Subtitle HELICOPTER MANEUVERING: MLS SHUTTLE HOLDING PATTERN DATA REPORT	5. Report Date August 1987
	6. Performing Organization Code ACT-140
7. Author(s) Christopher J. Wolf and Raquel Y. Santana	8. Performing Organization Report No. DOT/FAA/CT-TN86/63
9. Performing Organization Name and Address Department of Transportation Federal Aviation Administration Technical Center Atlantic City International Airport, N.J. 08405	10. Work Unit No. (TRAIS)
	11. Contract or Grant No. T0170P
12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Administration Program Engineering and Maintenance Service Washington, D.C. 20590	13. Type of Report and Period Covered Technical Note May 1987
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report documents the Federal Aviation Administration (FAA) Technical Center's flight test on Microwave Landing System (MLS) shuttle holding patterns. This flight test was undertaken in response to the Aviation Standards National Field Office (AVN) to provide data on the shuttle holding pattern for inclusion in chapter 11 of the Terminal Instrument Procedures (TERPS) manual.

Data were collected for MLS shuttle holding patterns using two different course width sensitivities. Data collection was performed using an Army UH-1 helicopter.

After the data were collected it was reduced and formatted and forwarded to AVN for analysis and development of TERPS criteria.

17. Key Words MLS Holding Patterns TERPS Helicopter	18. Distribution Statement This Document is on file at the Technical Center Library, Atlantic City International Airport, N.J. 08405

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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Technical Report Documentation Page

1. Report No. DOT/FAA/CT-TN86/64	2. Government Accession No. AD-A183153	3. Recipient's Catalog No.
4. Title and Subtitle HELIPORT CRITICAL AREA FLIGHT TEST RESULTS		5. Report Date February 1987
		6. Performing Organization Code ACT-140
7. Author(s) Barry R. Billmann, Michael M. Webb, John G. Morrow, Donald W. Gallagher, Christopher J. Wolf		8. Performing Organization Report No. DOT/FAA/CT-TN86/64
9. Performing Organization Name and Address U.S. Department of Transportation Federal Aviation Administration Technical Center Atlantic City International Airport, N.J. 08405		10. Work Unit No. (TRAIS)
		11. Contract or Grant No. T0701H
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration Program Engineering and Maintenance Service Washington, D.C. 20590		13. Type of Report and Period Covered Technical Note
		14. Sponsoring Agency Code APM-450

15. Supplementary Notes

APM-450, Helicopter Program

16. Abstract

The development of the microwave landing system (MLS) has resulted in the need for several different flight tests to optimize the utility of MLS. One such series of tests were designed to define criteria for siting MLS antennas at heliports. Due to the unique maneuver capabilities and the limited real estate available at heliports, flight tests were also conducted to determine the airspace and real estate surrounding the MLS antennas which must be protected when the MLS is sited at heliports. The need for this protected region is to guarantee signal coverage and quality. Based on the test flight results conducted at the Federal Aviation Administration (FAA) Technical Center, a minimum region (surrounding the MLS antennas and signal monitor poles) which must be protected is identified.

17. Key Words	18. Distribution Statement
Helicopter MLS Heliport Instrument Approaches	This Document is Available to the U.S. Public Through the National Technical Information Service, Springfield, VA 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/PM-87/2	AD-A179104	

4. Title and Subtitle	5. Report Date
Very Short Range Statistical Forecasting of Automated Weather Observations	February 1987
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Robert G. Miller	
9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Office of Systems Development, Techniques Development Laboratory, 8060 13th Street, Silver Spring, Maryland 20910	156-410-010
	11. Contract or Grant No.
	DTFA01-83-Y-20625
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
U.S. Department of Transportation, Federal Aviation Administration, Program Engineering and Maintenance Service, Helicopter Program, APM-450; Washington, D.C. 20591	Interim Report (3rd) October 1985-September 1986
	14. Sponsoring Agency Code
	FAA/APM-450/APM-650

15. Supplementary Notes

Prepared under FAA/NWS Interagency Agreement No. DTFA01-83-Y-20625, managed by Weather Sensors Program, APM-650, Flight Information Division; and Helicopters Program, APM-450, Navagation and Landing Division.

16. Abstract

A procedure is developed for providing weather forecasting guidance over the short range period of 10, 20, 30, ..., 60 minutes. It uses the automated weather observing system (AWOS) elements as predictors and predictands. The model is founded on Markov assumptions and uses multivariate linear regression as the statistical operator. Details are given on how the Generalized Exponential Markov (GEM) model compares with persistence. Tests are performed on an independent data sample. Overall, GEM succeeds in bettering current short range weather forecasting techniques (i.e., persistence) over the six projection periods of 10, 20, 30, ..., 60 minutes.

17. Key Words	18. Distribution Statement
Short-range weather forecasts Statistical weather forecasts Markov Generalized Equivalent Markov (GEM) Multivariate linear regression	Document is available to the public through the National Technical Information Service, Springfield, Virginia 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/CT-TN87/4		
4. Title and Subtitle: Simulation Tests of Proposed Instrument Approach Lighting Systems for Helicopter Operations		5. Report Date: March 1987
		6. Performing Organization Code: ACT - 310
7. Author(s): Paul H. Jones		8. Performing Organization Report No.: DOT/FAA/CT-TN87/4
9. Performing Organization Name and Address: Federal Aviation Administration, Technical Center, Atlantic City Airport, N.J. 08405		10. Work Unit No. (TRAIS)
		11. Contract or Grant No.
		13. Type of Report and Period Covered: Technical Note
12. Sponsoring Agency Name and Address: Federal Aviation Administration, Helicopter Program Branch, APM-450, Washington, D.C. 20591		14. Sponsoring Agency Code: APM-450
15. Supplementary Notes		

16. Abstract

The purpose of this evaluation was to determine the effectiveness of proposed Instrument Flight Rules (IFR) Heliport Approach Lighting Systems under reduced visibility conditions.

Simulation test were conducted of proposed instrument approach lighting systems for heliport operations using the NASA Langley Research Center's Visual Motion Simulator. Each approach lighting configuration was paired with its associated reduced visibility criteria as specified by the Flight Procedure Standards Branch, AFS-230.

During the evaluation, pilots were instructed to fly 24 precision approaches to the heliport. Upon breakout, they were to proceed to the heliport visually using the approach lighting provided. Pilots were asked to rate the visual guidance provided by the approach lighting system after completion of each approach.

In virtually all instances the pilots felt that the approach lighting systems presented were adequate under the existing visibility conditions. Pilot comments indicated that they preferred the closer spacing between the light bars and that the wingbars added "rate of closure" information to the longer systems.

17. Key Words	18. Distribution Statement
Helicopter Heliport Instrument Approach Lighting	Document is on file at the Technical Center Library, Atlantic City International Airport, N.J. 08405

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/CT-TN87/10	AD-A189141	

4. Title and Subtitle

HELIPORT PARKING, TAXIING, AND LANDING AREA CRITERIA TEST PLAN

5. Report Date

July 1987

6. Performing Organization Code

ACT-140

7. Author(s)

Rosanne M. Weiss

8. Performing Organization Report No.

DOT/FAA/CT-TN87/10

9. Performing Organization Name and Address

U.S. Department of Transportation
Federal Aviation Administration
Technical Center
Atlantic City International Airport, N.J. 08405

10. Work Unit No. (TRAIS)

11. Contract or Grant No.

T0701R

12. Sponsoring Agency Name and Address

U.S. Department of Transportation
Federal Aviation Administration
Program Engineering and Maintenance Service
Washington, D.C. 20590

13. Type of Report and Period Covered

Technical Note
July 1987

14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This flight test plan describes the methodology to examine and validate the current heliport surface separation and maneuvering criteria as defined in the Heliport Design Guide and determine if changes can be made to the current criteria. Operational measures will be collected at the Indianapolis Heliport, Indiana, and Wall Street Heliport, New York. Additional flight tests will be conducted at the Federal Aviation Administration (FAA) Technical Center, Atlantic City International Airport, New Jersey, using instrumented UH-1H and S-76 helicopters.

Flight manuevers at the Technical Center are to identify vertical variation from the recommeded taxiing heights and lateral variation from a predetermined path, under various wind and lighting conditions. Wind velocity and barometric pressure data will be collected during hover operations to determine rotorwash effects at different locations around a helipad, taxiway, and parking areas. This data will be used to create a baseline to be used in characterizing heliport surface maneuver areas. The test development, test equipment, data collection, and data reduction and analysis of the flight data are discussed. A schedule for the completion of the associated tasks is presented.

17. Key Words

Surface Maneuver	Heliport
Peripheral Area	Helicopter
Parking Areas/Heliport	Taxiways
Separation Criteria	
Heliport Parking	

18. Distribution Statement

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19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/CT-TN87/16	AD-A183299	

4. Title and Subtitle	
TEST PLAN FOR HELICOPTER GPS APPLICATIONS	5. Report Date May 1987
	6. Performing Organization Code ACT-140
7. Author(s) Michael Magrogan	8. Performing Organization Report No. DOT/FAA/CT-TN87/16
9. Performing Organization Name and Address Department of Transportation Federal Aviation Administration Technical Center Atlantic City International Airport, N.J. 08405	10. Work Unit No. (TRAIS) 11. Contract or Grant No. T0701N
12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Administration Program Engineering and Maintenance Service Washington, D.C. 20590	13. Type of Report and Period Covered Technical Note 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This test plan describes a project designed to collect data via flight testing from the Global Positioning System (GPS) when receivers are mounted on helicopters. GPS issues to be investigated include antenna location, satellite shielding, and multipath influences which might occur with rotorcraft applications in urban downtown areas. Minimum masking angle issues will also be addressed.

GPS integrated with other navigation and guidance systems such as microwave landing system (MLS) and Loran C will also be investigated. Both precision (P) and coarse/acquistion (C/A) code receivers will be evaluated. In addition, studies will be carried out to determine how to install a GPS antenna on composite body aircraft. Further studies may be related to automatic dependent surveillance functions. Future work will include evaluation of a GPS P code receiver as a reference for flight inspection.

17. Key Words	18. Distribution Statement
GPS Flight Inspection Satellite Navigation	This document is available to the U.S. public through the National Technical Information Service, Springfield, Va. 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/CT-87/19	AD-A199212	

4. Title and Subtitle	5. Report Date
AVIONICS SYSTEM DESIGN FOR HIGH ENERGY FIELDS	July 1988
	6. Performing Organization Code
	8. Performing Organization Report No. DOT/FAA/CT-87/19
7. Author(s) Roger A McConnell	
9. Performing Organization Name and Address CK Consultants, Inc. 5473A Clouds Rest Mariposa, CA 95338	10. Work Unit No. (TRAIS) 11. Contract or Grant No. NAS2-12448
12. Sponsoring Agency Name and Address U. S. Department of Transportation Federal Aviation Administration Technical Center Atlantic City International Airport, New Jersey 08405	13. Type of Report and Period Covered Contractor Report 14. Sponsoring Agency Code

15. Supplementary Notes

Point of Contact: W. E. Larsen/MS 210-2, NASA/Ames Research Center, Moffett Field, CA 94035; Pete Saraceni, ACT-340, FAA Technical Center, Atlantic City International Airport, NJ 08405

16. Abstract

Because of the significant differences in transient susceptibility, the use of digital electronics in flight critical systems, and the reduced shielding effects of composite materials, there is a definite need to define design practices which will minimize electromagnetic susceptibility, to investigate the operational environment, and to develop appropriate testing methods for flight critical systems.

A major part of this report describes design practices which will lead to reduced electromagnetic susceptibility of avionics systems in high energy fields. A second part describes the level of emission that can be anticipated from generic digital devices. It is assumed that as data processing equipment becomes an ever larger part of the avionics package, the construction methods of the data processing industry will increasingly carry out into aircraft. These portions of the report should, therefore, be of particular interest to avionics engineers and designers.

This report includes an extensive bibliography on electromagnetic compatibility and avionics issues.

17. Key Words	18. Distribution Statement
Electromagnetic Compatibility, Susceptibility, Radiation, Emission, Conduction, Coupling, Shielding, Composite Materials, Digital Electronics	Document is available to the public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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Technical Report Documentation Page

1. Report No. DOT/FAA/CT-TN87/19	2. Government Accession No. AD-A189424	3. Recipient's Catalog No.

4. Title and Subtitle

MICROWAVE LANDING SYSTEM AREA NAVIGATION (MLS RNAV) TRANSFORMATION ALGORITHMS AND ACCURACY TESTING

5. Report Date

July 1987

6. Performing Organization Code

ACT-140

7. Author(s)

Barry R. Billmann, James H. Remer, and Min-Ju Chang

8. Performing Organization Report No.

DOT/FAA/CT-TN87/19

9. Performing Organization Name and Address

Department of Transportation
Federal Aviation Administration
Technical Center
Atlantic City International Airport, N.J. 08405

10. Work Unit No. (TRAIS)

11. Contract or Grant No.

T0701G

12. Sponsoring Agency Name and Address

Department of Transportation
Federal Aviation Administration
Program Engineering and Maintenance Service
Washington, D.C. 20590

13. Type of Report and Period Covered

Technical Note

14. Sponsoring Agency Code

APM-450

15. Supplementary Notes

Helicopter Program

16. Abstract

Microwave Landing System Area Navigation (MLS RNAV) is a technique which affords the ability to perform precision navigation in the terminal area of a heliport or airport. It utilizes the signal coverage provided by the MLS angle data transmitters and associated precision distance measuring equipment (DME/P). Navigation performed using an MLS RNAV system is not limited to approaches along a runway centerline or azimuth radial, but may assume any conceivable flightpath within MLS coverage. Examples of these types of approaches would include curves, segmented and oblique offset (parasite), as well as computed centerline (offset) approaches. The work presented herein treats MLS RNAV from a theoretical perspective. MLS RNAV transformation algorithms are developed and tested under real world and laboratory conditions. Anticipated system accuracy is computed under various anticipated operational scenarios. These scenarios include parasite and computed centerline approaches, including the effects of signal source error. The effects on total system accuracy of offsetting the conical elevation transmitter from the runway centerline are presented. The errors associated with computed centerline approaches when the azimuth is offset from the runway centerline is presented.

17. Key Words

Area Navigation (RNAV)
Helicopter
Microwave Landing System (MLS)
Heliport

18. Distribution Statement

This Document is Available to the U.S. Public Through the National Technical Information Service, Springfield, Va. 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/CT-TN87/21	AD-A191719	

4. Title and Subtitle	
ROTORCRAFT TCAS EVALUATION GROUP 3 RESULTS	5. Report Date October 1987
	6. Performing Organization Code ACT-140
7. Author(s) Albert J. Rehmann	8. Performing Organization Report No. DOT/FAA/CT-TN87/21
9. Performing Organization Name and Address Department of Transportation Federal Aviation Administration Technical Center Atlantic City International Airport, N.J. 08405	10. Work Unit No. (TRAIS) 11. Contract or Grant No. T1102A
	13. Type of Report and Period Covered Technical Note September - December 1985
12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Administration Program Engineering and Maintenance Service Washington, D.C. 20590	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report documents the operational flight test of a prototype Traffic Alert and Collision Avoidance System (TCAS) installed in a Sikorsky S-76 helicopter. The prototype TCAS, programmed to encompass the functions of a TCAS I, was flown to five east coast terminal cities, and operated along defined helicopter routes therein. The test results validated the minimum proposed TCAS I configuration. Further results recommend enhancements, to be included as options to improve the usefulness of TCAS I.

17. Key Words	18. Distribution Statement
Airborne Collision Avoidance TCAS, TCAS I Helicopter Safety Helicopter Accident Prevention	This Document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	64	

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Technical Report Documentation Page

1. Report No. DOT/FAA/PM-87/31 DOT/FAA/PP-88/1	2. Government Accession No. AD-A195283	3. Recipient's Catalog No.
4. Title and Subtitle Analyses of Heliport System Plans		5. Report Date February 1988
		6. Performing Organization Code
7. Author (s) Deborah Peisen, Jack Thompson		8. Performing Organization Report No. 5542-6A2
9. Performing Organization Name and Address Systems Control Technology, Inc. 1611 North Kent Street, Suite 910 Arlington, Virginia 22209		10. Work Unit No. (TRAIS)
		11. Contract or Grant No. DTFA01-87-C-00014
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration 800 Independence Avenue, S.W. Washington, D.C. 20591		13. Type Report and Period Covered Final Report
		14. Sponsoring Agency Code APS - 450, APP - 400

15. Supplementary Notes

APS-450, Rotorcraft Program Office, Program Engineering Service
APP-400, National Planning Division, Office of Airport Planning and Programing

16. Abstract

State and city governments generally realize that continued vitality depends on a steady expansion of industry and services as a function of planned growth. The helicopter is a proven catalyst for enhancement of those desired growth patterns. However, without the necessary support infrastructure, this positive contribution of the helicopter cannot be realized. Determining the need for such a support system can be achieved through an understanding of local helicopter activities and the metropolitan or state-wide socio-economic dynamics in which they occur. This allows for data base development, including a fleet inventory, and analysis to provide a foundation for determining current, and forecasting future, helicopter activity and support facility requirements.

The purpose of this study is to analyze the strengths and weaknesses of various existing heliport system plans. Planning concepts are identified and defined to include: 1) baseline parameters for evaluating the plans, 2) identifying data and their sources needed for planning purposes at any jurisdictional level, and 3) developing criteria for assessing the feasibility and economic viability of proposed heliport facilities.

The study covers four state heliport system plans (Michigan, New Jersey, Louisiana, and Ohio) and four metropolitan heliport plans (Pittsburgh, PA; Phoenix, AZ; Houston, TX; and Washington, D.C.).

This is the first document in a series of three intended to encourage and assist planners in heliport system plan development. The other documents are:

Four Urban Heliport Case Studies, DOT/FAA/PM-87/32, DOT/FAA/PP-88/2
Heliport System Planning Guidelines, DOT/FAA/PM-87/33, DOT/FAA/PP-88/3

17. Key Words Heliport System Plans Heliport Planning	18. Distribution Statement This document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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Technical Report Documentation Page

1. Report No. DOT/FAA/PM-87/32 DOT/FAA/PP-88/2	2. Government Accession No. AD-A195284	3. Recipient's Catalog No.
4. Title and Subtitle Four Urban Heliport Case Studies		5. Report Date March 1988
		6. Performing Organization Code
7. Author (s) Deborah Peisen, Jack Thompson		8. Performing Organization Report No. 5542-6A3
9. Performing Organization Name and Address Systems Control Technology, Inc. 1611 North Kent Street, Suite 910 Arlington, Virginia 22209		10. Work Unit No. (TRAIS)
		11. Contract or Grant No. DTFA01-87-C-00014
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration 800 Independence Avenue, S.W. Washington, D.C. 20591		13. Type Report and Period Covered Final Report
		14. Sponsoring Agency Code APS - 450, APP - 400

15. Supplementary Notes

APS-450, Rotorcraft Program Office, Program Engineering Service
APP-400, National Planning Division, Office of Airport Planning and Programing

16. Abstract

State and city governments generally realize that continued vitality depends on a steady expansion of industry and services as a function of planned growth. The helicopter is a proven catalyst for enhancement of those desired growth patterns. However, without the necessary support infrastructure, this positive contribution of the helicopter cannot be realized. Determining the need for such a support system can be achieved through an understanding of local helicopter activities and the metropolitan or state-wide socio-economic dynamics in which they occur. This allows for data base development, including a fleet inventory, and analysis to provide a foundation for determining current, and forecasting future, helicopter activity and support facility requirements.

The purpose of this study is to develop case histories for public-use heliports built in the Central Business District (CBD) of several major metropolitan areas. Within each case history, "common denominators" are identified that are useful for planners in assessing the viability of heliport proposals in cities that exhibit similar demographic characteristics. Each case study provides a general background as a setting and an inventory of pertinent heliport data; including location, cost (when available), history, funding and revenue sources, operational characteristics, etc.; addresses social concerns such as the local industrial base, neighboring land uses and zoning; and the public and governmental attitudes toward the heliport.

The study contains histories of four heliports, specifically: the Bank-Whitmore Heliport (aka Nashua Street Heliport) in Boston, MA; the Downtown Heliport in Indianapolis, IN; the Downtown Heliport in New Orleans, LA; and the Western and Southern Heliport in Cincinnati, OH.

This is the second document in a series of three intended to encourage and assist planners in heliport system plan development. The other documents are:

Analyses of Heliport Systems Plans, DOT/FAA/PM-87/31, DOT/FAA/PP-88/1
Heliport System Planning Guidelines, DOT/FAA/PM-87/33, DOT/FAA/PP-88/3

17. Key Words Bank-Whitmore Heliport, Heliport Case Studies Nashua Street Heliport, Urban Heliports Indianapolis Downtown Heliport, Prototype Western and Southern Heliport	18. Distribution Statement This document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	58	

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/PM-87/33 DOT/FAA/PP-88/3	AD-A199081	

4. Title and Subtitle Heliport System Planning Guidelines	5. Report Date April 1988 6. Performing Organization Code
7. Author (s) Deborah Peisen	8. Performing Organization Report No. 5542-6A4
9. Performing Organization Name and Address Systems Control Technology, Inc. 1611 North Kent Street, Suite 910 Arlington, Virginia 22209	10. Work Unit No. (TRAIS) 11. Contract or Grant No. DTFA01-87-C-00014
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration 800 Independence Avenue, S.W. Washington, D.C. 20591	13. Type Report and Period Covered Final Report 14. Sponsoring Agency Code APS - 450, APP - 400

15. Supplementary Notes

APS-450, Rotorcraft Program Office, Program Engineering Service
APP-400. National Planning Division, Office of Airport Planning and Programing

16. Abstract

State and city governments generally realize that continued vitality depends on a steady expansion of industry and services as a function of planned growth. The helicopter is a proven catalyst for enhancement of those desired growth patterns. However, without the necessary support infrastructure, this positive contribution of the helicopter cannot be realized. Determining the need for such a support system can be achieved through an understanding of local helicopter activities and the metropolitan or state-wide socio-economic dynamics in which they occur. This allows for data base development, including a fleet inventory, and analysis to provide a foundation for determining current, and forecasting future, helicopter activity and support facility requirements.

Heliport planning is a relatively new field. Previous efforts, although based on proven fixed-wing airport methods, have produced a series of uncoordinated and nonstandardized products from many various individual planners and organizations. Consequently, the data collected and the analytical processes used have not been consistant or directly comparable. This document presents fundamental planning criteria by which urban area heliport requirements may be assessed at any jurisdictional level. It offers standardization for comparability of real demand and for funding prioritization.

This is the third document in a series of three intended to encourage and assist planners in heliport system plan development. The other documents are:

Analyses of Heliport Systems Plans, DOT/FAA/PM-87/31, DOT/FAA/PP-88/1
Four Urban Heliport Case Studies, DOT/FAA/PM-87/32, DOT/FAA/PP-88/2

17. Key Words		18. Distribution Statement
Heliport System Plans	Heliport Forecasting	This document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161.
Heliport Planning	Heliport Site Selection	
Urban Heliports	Heliport Data Collection	
Heliport Data Development	Heliport Benefits	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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Technical Report Documentation Page

1. Report No. DOT/FAA/CT-TN87/40, I	2. Government Accession No. AD-A193416	3. Recipient's Catalog No.
4. Title and Subtitle HELIPORT VISUAL APPROACH AND DEPARTURE AIRSPACE TESTS, VOLUME I SUMMARY		5. Report Date August 1988
		6. Performing Organization Code ACT-140
7. Author(s) Rosanne M. Weiss, Christopher J. Wolf, Maureen Harris, and James Triantos		8. Performing Organization Report No. DOT/FAA/CT-TN87/40, I
9. Performing Organization Name and Address Department of Transportation Federal Aviation Administration Technical Center Atlantic City International Airport, N.J. 08405		10. Work Unit No. (TRAIS)
		11. Contract or Grant No. T0701R
12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Administration Rotorcraft Technology Branch, ADS-220 Washington, D.C. 20590		13. Type of Report and Period Covered Technical Note March - July 1987
		14. Sponsoring Agency Code ADS-220, AAS-100
15. Supplementary Notes		

16. Abstract

During the winter and spring of 1987 flight tests were conducted at the Federal Aviation Administration (FAA) Technical Center's Concepts Development and Demonstration Heliport at the Atlantic City International Airport, N.J. The purpose of these flights was to examine and validate the current heliport approach/departure surfaces criteria as defined in the Heliport Design Guide and to recommend modifications to these surfaces, if appropriate. The flight activities were conducted using aircraft representative of those in the civilian world. Data were collected using approach surfaces of 7.125°, 8.00°, and 10.00° for straight as well as curved path procedures. Also, departure surfaces of 7.125°, 10.00°, and 12.00° for straight and curved path procedures were used. All maneuvers were tracked by ground based tracking systems.

This report documents the results of this activity. It describes the flight test and evaluation methodology and addresses technical as well as operational issues. It provides statistical and graphical analysis of pilot performance along with a discussion of pilot subjective opinions concerning the acceptability and perceived workload, safety, and control margins associated with the procedures flown.

The results of this work will be considered in the future modifications of the FAA Heliport Design Advisory Circular, AC 150/5390-2.

17. Key Words Heliport Approach Surface Departure Profile Heliport Design Advisory Circular	18. Distribution Statement This document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161

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Unclassified	Unclassified	40	

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Technical Report Documentation Page

1. Report No. PS-88-1-LR	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle FAA Rotorcraft Research, Engineering and Development - Bibliography, 1964-1987		5. Report Date February 1988 6. Performing Organization Code APS-450
7. Author(s) Robert D. Smith		8. Performing Organization Report No.
9. Performing Organization Name and Address Federal Aviation Administration Program Engineering Service Helicopter Program Office, APS-450 Washington, D.C. 20591		10. Work Unit No. (TRAIS) 11. Contract or Grant No.
12. Sponsoring Agency Name and Address Federal Aviation Administration Program Engineering Service Helicopter Program Office, APS-450 Washington, D.C. 20591		13. Type of Report and Period Covered Bibliography 1964-1987 14. Sponsoring Agency Code APS-450
15. Supplementary Notes		

16. Abstract

This is a bibliography of FAA rotorcraft reports published in the 1964-1987 time period. This report is a supplement to an earlier bibliography "FAA Helicopter/Heliport Research, Engineering, and Development - Bibliography, 1964-1986" (FAA/PM-86/47) (AD-A174697). Both bibliographies are limited to documents in which the research, engineering, and development elements of the FAA were involved as sponsors, participants, or authors.

(Note: This document has been superseded by DOT/FAA/DS-89/03, FAA Rotorcraft Research, Engineering and Development - Bibliography, 1962-1988.)

17. Key Words Helicopter Heliport Rotorcraft Bibliography		18. Distribution Statement Distribution unlimited. See page 1 for availability.	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 64	22. Price

Form DOT F 1700.7 (8-72)

1. Report No.
DOT/FAA/PS-88/3

2. Government Accession No.
AD-A190803

3. Recipient's Catalog No.

4. Title and Subtitle
Very Short Range Statistical Forecasting Of Automated Weather Observations

5. Report Date
January 1988

6. Performing Organization Code

8. Performing Organization Report No.

7. Author's)
Robert G. Miller, Ph. D.

9. Performing Organization Name and Address
U. S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Office of Systems Development, Techniques Development Laboratory, 8060 13th St., Silver Spring, MD 20910

10. Work Unit No. (TRAIS)
156-410-010

11. Contract or Grant No.
DTFA01-83-Y-20625

12. Sponsoring Agency Name and Address
U. S. Dept. of Transportation, Federal Aviation Administration, Program Engineering Service, Weather Sensors Program, APS-550, 800 Independence Ave., Washington, D. C. 20591

13. Type of Report and Period Covered
Final Report
Oct. 1986 - Sept. 1987

14. Sponsoring Agency Code
FAA/APS-550/APS-450

15. Supplementary Notes
Prepared under FAA/NWS Interagency Agreement No. DTFA01-83-Y-20625, managed by Weather Sensors Program, APS-550, Communications and Weather Facilities Division; and Helicopter Program, APS-450, Navigation and Landing Division.

16. Abstract
A procedure is developed for providing weather forecasting guidance over the short range period of 10, 20, 30, ..., 120 minutes. It uses the Automated Weather Observing System (AWOS) elements as predictors and predictands. The model is founded on Markov assumptions and uses multivariate regression as the statistical operator. Details are given on how the Generalized Exponential Markov (GEM) model compares with persistence. Tests are performed on a test sample of almost 400,000 cases. Overall, GEM succeeds in bettering current short range weather forecasting techniques (i.e. persistence) over the twelve projection periods of 10, 20, 30..., 120 minutes. The ability of GEM to successfully predict VFR to IFR, and IFR to LOW IFR changes in both visibility and ceiling is also demonstrated.

17. Key Words
Short Range Weather Forecasts
Statistical Weather Forecasts
Markov
Generalized Equivalent Markov
Multivariate Linear Regression

18. Distribution Statement
Document is available to the public through the National Technical Information Service, Springfield, VA 22161.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	239	

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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/CT-TN88/5	AD-A200027	

4. Title and Subtitle
HELIPORT VISUAL APPROACH SURFACE HIGH TEMPERATURE AND HIGH ALTITUDE TEST PLAN

5. Report Date
June 1988

6. Performing Organization Code
ACT-140

7. Author(s)
Marvin S. Plotka and Rosanne M. Weiss

8. Performing Organization Report No.
DOT/FAA/CT-TN88/5

9. Performing Organization Name and Address
U.S. Department of Transportation
Federal Aviation Administration
Technical Center
Atlantic City International Airport, N.J. 08405

10. Work Unit No. (TRAIS)

11. Contract or Grant No.
T0701R

12. Sponsoring Agency Name and Address
U.S. Department of Transportation
Federal Aviation Administration
Rotorcraft Technology, ADS-220
Washington, D.C. 20590

13. Type of Report and Period Covered
Technical Note
October-December 1987

14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This Technical Note identifies procedures to be used during tests to be conducted at the Albuquerque International Airport (ABQ), Albuquerque, New Mexico. These tests are designed to evaluate the applicability of existing heliport approach and departure surface criteria under high temperature and high altitude conditions. A UH-1H aircraft will be used. This project is similar to the work documented in DOT/FAA/CT-TN87/40 "Heliport Approach and Departure Airspace Tests."

17. Key Words
VMC Approach Surfaces, Heliport
Helicopter, Clear Surfaces
High Density Altitude
High Altitude

18. Distribution Statement
This document is available to the U.S. public through the National Technical Information Service, Springfield, Va. 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/DS-88/5	AD-A197694	

4. Title and Subtitle
Aeronautical Decision Making For Air Ambulance Helicopter Pilots: Learning From Past Mistakes

5. Report Date
July 1988

6. Performing Organization Code

7. Author (s)
R. J. Adams, J. L. Thompson

8. Performing Organization Report No.

9. Performing Organization Name and Address
Systems Control Technology, Inc.
1611 North Kent Street, Suite 910
Arlington, Virginia 22209

10. Work Unit No. (TRAIS)

11. Contract or Grant No.
DTFA01-87-C-00014, W.O.5A

12. Sponsoring Agency Name and Address
U.S. Department of Transportation
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, D.C. 20591

13. Type Report and Period Covered
Final Report

14. Sponsoring Agency Code
ADS-220

15. Supplementary Notes
Advanced System Design Service
System Technology Division
Rotorcraft Technology Branch, ADS-220

16. Abstract
The following materials are based upon actual helicopter air ambulance accidents. They focus on the importance of decision making and judgement during all phases of flight. Improving safety is a shared responsibility between hospital administrators, vendors, chief pilots, head nurses, pilots, air medics, dispatchers and physicians. It is to everyones advantage to establish and support an operational frame of reference that will ensure safety.

These accident synopses are the first element of a multi-volume set of training materials designed to significantly reduce the helicopter air ambulance accident rate and to keep it under control thereafter. The other volumes include:

Aeronautical Decision Making for Helicopter Pilots
Aeronautical Decision Making for Air Ambulance Helicopter Pilots: Situational Awareness Exercises
Risk Management for Air Ambulance Helicopter Operators
Aeronautical Decision Making for Air Ambulance Helicopter Program Administrators

The accident summaries, risk anayses and lessons learned are taken directly from helicopter air ambulance history. They enhance the basic manual: "Aeronautical Decision Making for Helicopter Pilots" by providing an insight to the types of decision errors which contributed to accidents in the past. This manual contains introductory and tutorial material necessary for improving basic decision making skills. Some material contained in that manual and not included in this one are: rotorcraft risk assessment; the self-awareness inventory; identifying and reducing stress; and headwork. Reading and understanding the concepts of decision making will improve the pilot's ability to analyze the accident scenarios contained herein.

17. Key Words
Human Factors, Judgement, Human Performance, Decision Making, Aviation Safety, Helicopter Pilot, Aviation Training, Helicopters, Pilot Error, Rotorcraft

18. Distribution Statement
This document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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Technical Report Documentation Page

1. Report No	2. Government Accession No.	3. Recipient's Catalog No.
DOT/FAA/DS-88/6	AD-A200274	

4. Title and Subtitle	5. Report Date
Aeronautical Decision Making for Air Ambulance Helicopter Pilots: Situational Awareness Exercises	July 1988
	6. Performing Organization Code
7. Author (s) R. J. Adams, J.L. Thompson	8. Performing Organization Report No.
9. Performing Organization Name and Address Systems Control Technology, Inc. 1611 North Kent Street, Suite 910 Arlington, Virginia 22209	10. Work Unit No. (TRAIS) 11. Contract or Grant No. DTFA01-87-C-00014, W.O.5A
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration 800 Independence Avenue, S.W. Washington, D.C. 20591	13. Type Report and Period Covered Final Report 14. Sponsoring Agency Code ADS-220

15. Supplementary Notes
Advanced System Design Service
System Technology Division
Rotorcraft Technology Branch, ADS-220

16. Abstract

The following materials are based upon actual helicopter air ambulance accidents. They cover four broad accident types most recently associated with aeromedical accidents: night flying, weather, obstacle strikes, and mechanical failures. Three types of information are included for each accident type. These are: introductory/background material to provide you with the historical importance and frequency of each accident type; training knowledge that should be learned in order to avoid mistakes of the past; and decision making exercises.

This is only one element of a multi-volume set of training materials designed to significantly reduce the helicopter air ambulance accident rate and keep it under control hereafter. The other volumes include:

Aeronautical Decision Making for Helicopter Pilots
Aeronautical Decision Making for Air Ambulance Helicopter Pilots: Learning From Past Mistakes
Risk Management for Air Ambulance Helicopter Operators
Aeronautical Decision Making for Air Ambulance Helicopter Program Administrators

These decision making exercises are based on accident reports with persons and places de-identified. They are meant to enhance the basic manual: "Aeronautical Decision Making for Helicopter Pilots" by providing an insight to the types of decision errors which contributed to accidents in the past. The basic manual contains introductory and tutorial material necessary for improving basic decision making skills. Some material contained in that manual and not included in this one are: rotorcraft risk assessment; the self-awareness inventory; identifying and reducing stress; and headwork. Reading and understanding the concepts of decision making will improve the pilot's ability to analyze the scenarios contained herein.

17. Key Words		18. Distribution Statement
Human Factors	Judgement	This document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161.
Human Performance	Decision Making	
Aviation Safety	Helicopter Pilot	
Aviation Training	Helicopters	
Pilot Error	Rotorcraft	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	46	

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Technical Report Documentation Page

1. Report No. DOT FAA CT-TN88/8	2. Government Accession No. AD-A197779	3. Recipient's Catalog No.
4. Title and Subtitle LORAN C OFFSHORE FLIGHT FOLLOWING (LOFF) IN THE GULF OF MEXICO		5. Report Date February 1988
		6. Performing Organization Code ACT-140
7. Author(s) Frank Lorge		8. Performing Organization Report No. DOT/FAA/CT-TN88/8
9. Performing Organization Name and Address Federal Aviation Administration Technical Center Atlantic City International Airport, NJ 08405		10. Work Unit No. (TRAIS)
		11. Contract or Grant No. T0702K
12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Administration Program Engineering and Maintenance Service Washington, DC 20590		13. Type of Report and Period Covered Technical Note February 1988
		14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The Federal Aviation Administration conducted simulation and flight tests on the Loran C Offshore Flight Following (LOFF) equipment installed in the Houston Air Route Traffic Control Center (ARTCC). Overall results of the LOFF test program were favorable. The system performs in a predictable and reasonable manner. Performance of the system is comparable to that of radar, although there is a slight difference in accuracy between the two.

17. Key Words Loran C Flight Following (LOFF) Gulf of Mexico Loran Automatic Dependent Surveillance (ADS)	18. Distribution Statement This document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	68	

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1. Report No. NASA CR 177483, Vol.I DOT/FAA/PS-88/8, Vol.I DOT/FAA/DS-88/2, Vol.I	2. Government Accession No. N88-25453	3. Recipient's Catalog No.
4. Title and Subtitle "Zero/Zero" Rotorcraft Certification Issues Volume I Executive Summary Volume II Plenary Session Presentations Volume III Working Group Results		5. Report Date July 1988 6. Performing Organization Code
7. Author (s) Richard J. Adams		8. Performing Organization Report No.
9. Performing Organization Name and Address Systems Control Technology, Inc. 1611 North Kent Street, Suite 910 Arlington, Virginia 22209		10. Work Unit No. (TRAIS) 11. Contract or Grant No. NAS2-12478
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration 800 Independence Avenue, S.W. Washington, D.C. 20591		13. Type Report and Period Covered Final Report 14. Sponsoring Agency Code ADS-220

15. Supplementary Notes

In a recent reorganization the FAA Rotorcraft R&D Program Branch, APS-450, has become the Rotorcraft Technology Branch, ADS-220.

16. Abstract

This report analyzes the "Zero/Zero" Rotorcraft Certification Issues from the perspectives of manufacturers, operators, researchers and the FAA. The basic premise behind this analysis is that "zero/zero", or at least extremely low visibility, rotorcraft operations are feasable today from both a technological and an operational standpoint. The questions and issues that need to be resolved are: What certification requirements do we need to ensure safety? Can we develop procedures which capitalize on the performance and maneuvering capabilities unique to rotorcraft? Will extremely low visibility operations be economically feasable?

Volume I of this report provides an overview of the Certification Issues Forum held in Phoenix, Arizona in August of 1987. It presents a consensus of 48 experts from the government, manufacturer, and research communities on 50 specific Certification Issues. The topics of Operational Requirements, Procedures, Airworthiness and Engineering Capabilities are discussed.

Volume II presents the operator perspectives (system needs), applicable technology and "zero/zero" concepts developed in the first 12 months of research of this project.

Volume III provides the issue-by-issue deliberations of the experts involved in the Working Groups assigned to deal with them in the Issues Forum.

17. Key Words Rotorcraft Helicopter Low Visibility Approaches Low Speed Approaches Advanced Approaches Steep Approaches Heliports	18. Distribution Statement This document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161

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4. Title and Subtitle "Zero/Zero" Rotorcraft Certification Issues Volume I Executive Summary Volume II Plenary Session Presentations Volume III Working Group Results		5. Report Date July 1988
		6. Performing Organization Code
7. Author (s) Richard J. Adams		8. Performing Organization Report No.
9. Performing Organization Name and Address Systems Control Technology, Inc. 1611 North Kent Street, Suite 910 Arlington, Virginia 22209		10. Work Unit No. (TRAIS)
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17. Key Words		18. Distribution Statement
Rotorcraft Helicopter Low Visibility Approaches Low Speed Approaches	Advanced Approaches Steep Approaches Heliports	This document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161

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4. Title and Subtitle	5. Report Date
Minimum Required Heliport Airspace Under Visual Flight Rules	October 1988
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Robert D. Smith	
9. Performing Organization Name and Address	10. Work Unit No (TRAIS)
Federal Aviation Administration Advanced System Design Service Rotorcraft Technology ADS-220 Washington, D.C. 20591	11. Contract or Grant No.
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Federal Aviation Administration Office of Airport Standards Design and Operations Criteria Division, AAS-100 Washington, D.C. 20591	Final Report
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

Recently, the FAA started a flight measurement project to examine the issue of minimum required VFR airspace. Test data were collected objectively in a manner similar to what is done to define the minimum airspace for a precision approach. Heliport approach and departure flight profiles were recorded using a variety of subject pilots flying several different helicopters. Data were analyzed statistically to determine the mean, standard deviation, and 6 sigma isoprobability curves. Results of this effort are documented in FAA report FAA/CT-TN87/40, Heliport Visual Approach and Departure Airspace Tests. An analysis of the statistical distribution of these data is contained in FAA/CT-TN88/44, Analysis of Distributions of VFR Heliport Data. These test reports are not likely to be the last word on this topic but they should serve to focus the discussion on specific issues in a way that is constructive. This report is intended to focus discussion on how the data should be interpreted, some of the historical issues involved, and the direction to be taken in future work.

17. Key Words	18. Distribution Statement
Heliport Design Approach/Departure Airspace Target Level of Safety Collision Risk Model	This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.

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1. Report No. DOT/FAA/CT-88/21	2. Government Accession No. AD-A199163	3. Recipient's Catalog No.
4. Title and Subtitle EXPERIMENTAL GUIDELINES FOR THE DESIGN OF TURBINE ROTOR FRAGMENT CONTAINMENT RINGS		5. Report Date July 1988 6. Performing Organization Code PE32 8. Performing Organization Report No. NAPC-PE-144
7. Author(s) James T. Salvino, Robert A. DeLucia and Tracy Russo		
9. Performing Organization Name and Address Commanding Officer Naval Air Propulsion Center P.O.Box 7176 Trenton, NJ 08628-0176		10. Work Unit No. (TRAIS) 11. Contract or Grant No. DOT-FA71NA-AP-98
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration Technical Center Atlantic City International Airport, New Jersey 08405		13. Type of Report and Period Covered Final 3/21/79 - 11/29/85 14. Sponsoring Agency Code ACT-320
15. Supplementary Notes PROJECT MANAGER: Bruce Fenton, Engine/Fuel Safety Branch Federal Aviation Administration Technical Center		

16. Abstract

Results of experimentation to determine design guidelines for turbine rotor fragment containment rings are presented in this report. The project consisted of two tasks. Task 1 was an investigation of the containment characteristics of cloth rings. Task 2 determined the engine casing thickness required for single and triple blade containment. This effort was conducted as part of the overall Rotor Fragment Protection Program.

17. Key Words Rotor Fragment Protection Single Single and Triple Blade Containment Rotor Failures Containment Rings		18. Distribution Statement Document is available to the U.S. public through the National Technical Information Service, Springfield, Virgina 22161	
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Technical Report Documentation Page

1. Report No. DOT/FAA/CT-88/23	2. Government Accession No. AD-A199002	3. Recipient's Catalog No.
4. Title and Subtitle STATISTICS ON AIRCRAFT GAS TURBINE ENGINE ROTOR FAILURES THAT OCCURRED IN U.S. COMMERCIAL AVIATION DURING 1982		5. Report Date July 1988
		6. Performing Organization Code PE32
7. Author's) R. A. Delucia and J. T. Salvino		8. Performing Organization Report No DOT/FAA/CT-88/23
9. Performing Organization Name and Address Commanding Officer Naval Air Propulsion Center PO Box 7176 Trenton, NJ 08628-0176		10. Work Unit No. (TRAIS)
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12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Administration Technical Center Atlantic City International Airport, NJ 08405		13. Type of Report and Period Covered FINAL REPORT
		14. Sponsoring Agency Code ACT-320

15. Supplementary Notes

PROJECT MANAGER: Bruce C. Fenton FAA Technical Center
Atlantic City International Airport, NJ 08405

16. Abstract

This report presents statistics relating to gas turbine engine rotor failures which occurred during 1982 in U. S. commercial aviation service use. One-hundred and sixty-one rotor failures occurred in 1982. Rotor fragments were generated in 88 of the failures and, of these, 16 were uncontained. The predominant failure involved blade fragments. Seven disk failures occurred and all were uncontained. Seventy percent of the 161 failures occurred during the takeoff and climb stages of flight.

This service data analysis is prepared on a calendar year basis and published yearly. The data support flight safety analysis, proposed regulatory actions, certification standards, and cost benefit analyses.

17. Key Words Air Transportation Aircraft Hazards Aircraft Safety Gas Turbine Engine Rotor Failures Containment	18. Distribution Statement This document is available to the U.S. Public through the National Technical Information Service, Springfield, Virginia 22161

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